TEXTILES PAPER LEATHER

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AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

VOLUME XIII NOVEMBER 17, 1924 NUMBER 19

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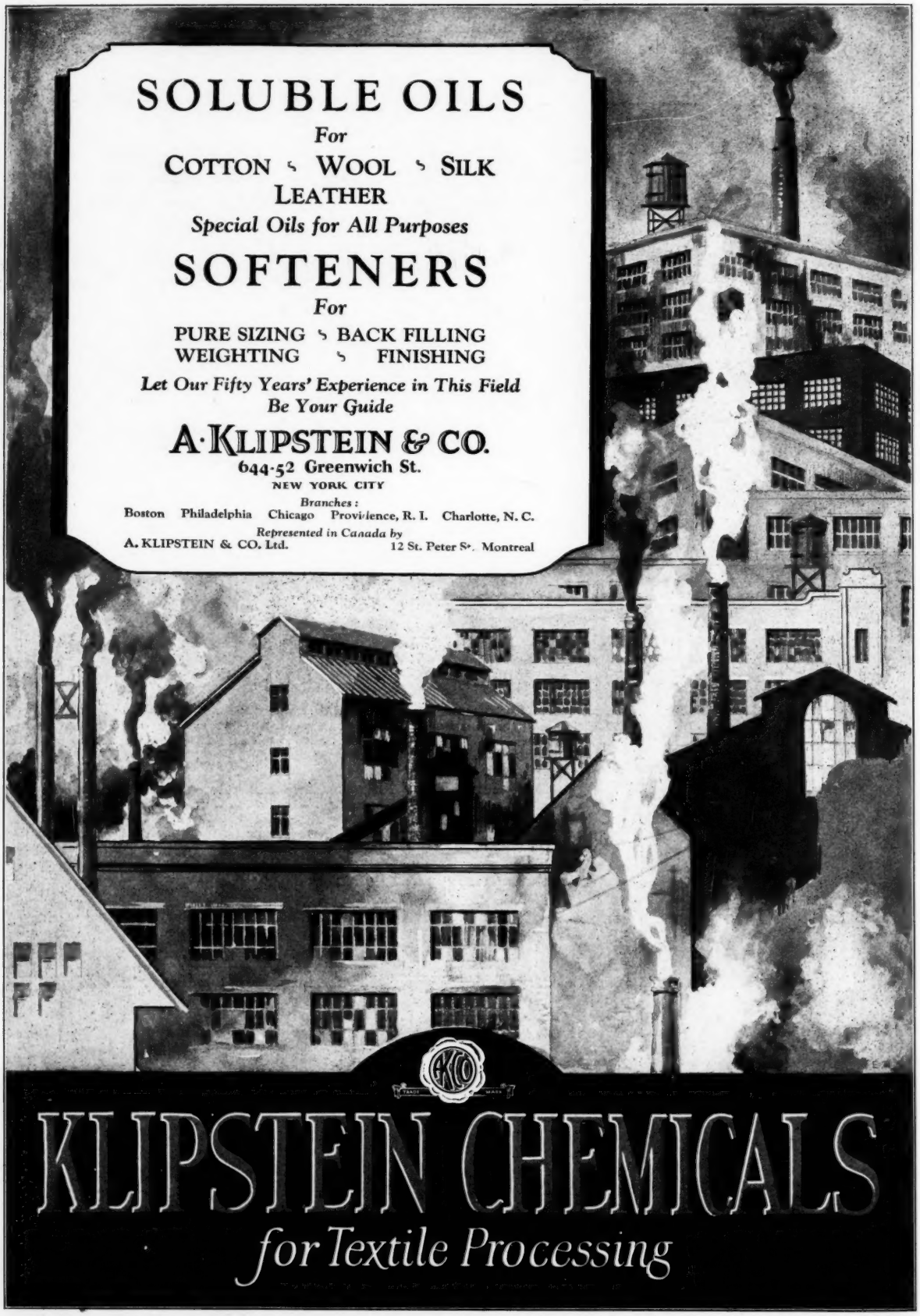

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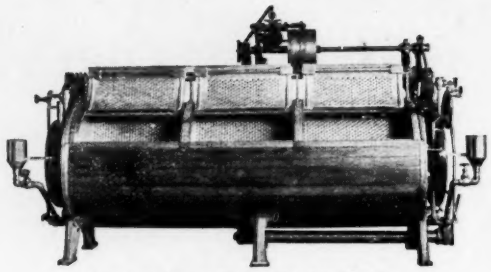

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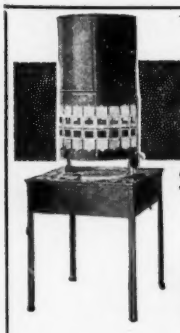

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VOLUME XIII NEW YORK, NOVEMBER 17, 1924 NUMBER 19

Dye Application in China

Part I

Materials Dyed and Dyes Used—Cotton Dyeing—Black on Cotton Piece Goods—Carbon Gray—Vegetable Black—Typical Chinese Dyehouse—Application of Vegetable Black—Mordanting and Dyeing—Finishing Cotton Piece Goods—Native Method of Calendering—Signs of Progressive Spirit

By WOO DONG CHI

[*A general description of native dyehouses and methods for dyeing cotton yarn and cloth, silk yarns and cloth, paper in sheets, and wool carpet yarn, with vegetable extracts and synthetic coal tar colors.*]

IN a previous article we outlined the use of indigo in the dyeing industry of China. Now we propose to tell something of the application of other colors to textiles and paper.

It has been remarked that there are in China practically no dyehouses such as are established in the Western countries. Much dyeing is done in the home, and the dye shops of to-day are outgrowths of this home industry.

The coloring of textiles in China probably dates back as far as in any other country in the world. Natural coloring matters, mostly of vegetable origin, are still used to-day in spite of the great development of the coal-tar color industry, and the introduction of its products all over the world.

Cotton goods are used most widely for the clothes of the millions of farmers who make up the bulk of China's population. Silk, for outer garments and house decorations for the well-to-do, and for export is an appreciable factor in dye consumption. Wool dyeing is confined almost entirely to yarn for the making of the so-called Tientsin carpets. Some hemp and jute are made into coarse cloths, part of which are dyed dark colors. Linen for summer clothing and embroidered napery consumes a small amount of color. In the south, straw and grass matting demand small quantities of pigments and basic colors. A beginning is being made in dyeing the straw braid produced in Shantung.

It is rather peculiar that there is in China a great consumption of color for the dyeing of paper. This is a development, we believe, from the time when China herself made all the paper she consumed. Then the paper was produced in its natural color and distributed throughout the country. Each household or village colored the paper which it used for decorations, wrappings and special documents according to their own requirements. Colored paper, especially red or scarlet, which are the propitious colors, play a large part in the life of the Chinese nation.

At present most of the paper used in the country is imported, since the modern paper mill can produce cheaper and more uniform qualities than the native industry. Plain, thin, unsized paper, rather brownish in color, is a standard article of commerce. It is kept in stock by certain shops in each village and given out to be dyed to the order of the customer, in the same way as is done with plain cotton calico. Dyehouses have been developed that specialize solely in the dyeing of paper.

Cotton Dyeing

With the foregoing as a preliminary we propose to take up the dyeing of the important materials in turn and shall deal first with cotton. In this country at the present time cotton is dyed as yarn or piece goods, never as raw stock. Cotton is not colored by printing. There is not now and we believe never has been any native printing with blocks or stencils, or tie dyeing, such as is known in Japan and Java. The modern calico printing plant has not yet made its appearance and probably will not do so for some years to come.

There is a large importation of plain and bleached calico. The modern weaving plants in the treaty ports and scattered through the interior turn out mostly this same kind of material. There are only four or five modern weaving factories with dyehouses attached. (There are not more than a dozen firms in the country who use modern dyeing machinery, and these confine themselves to one or more jigs each.) This calico, together with the large quantity of coarser unbleached cotton (nesell), woven on hand looms in the villages, go to the local piece-goods shops and are dyed to order in the small local dyeshops.

Some undyed yarn is imported, more is produced in the modern spinning mills in China, while the hand spinning wheel contributes its quota.

It is usual for yarn and cloth to be dyed in separate shops as the dyeing requires somewhat different procedure, and the workmen customarily specialize on one or the other.

Yarn dyeing is done in some hand-weaving center which will have a town or small city as a nucleus.

Blue is the principal color used, with black next. The bulk of the blue is produced by indigo and so is outside the scope of this article. Direct blues of the lowest priced varieties for producing imitations of sky to navy shades of indigo have been sold in the past in considerable quantity, particularly to the farmers for redyeing of old clothes. The wearing of black is very decidedly on the increase and is making inroads into the indigo and direct blue business.

Sulphur Blue, although advocated strongly by some color manufacturers, has never secured a foothold and does not seem likely to do so. The chief restrictions on its use are: (1) The native prejudice in favor of indigo, (2) the inferiority of the sulphur color in fastness and (3) the different dyeing method required—compared to indigo—and the greater cost of the color itself. Sulphur Blue, then, can be ruled out.

Vat blues, other than indigo, have made a strong bid to supplement or supersede the other color but without success. In spite of superior fastness properties the fact that they cannot be used with the usual fermentation vat and their greater difficulty generally in application has kept them from even a scattered use. There seems no indication of a change in this condition of affairs for a long time to come.

For blue, indigo is supreme in China, as related in detail in a previous paper.

Black on Cotton Piece Goods

Black on cotton piece goods is still produced to a large extent by natural coloring matters related to logwood. Such blacks, applied with an iron mordant, weight the material, an advantage from the cloth merchants' point of view. As the color is produced mostly with native materials the cost is relatively small. This has tended to keep down the price of the sulphur and direct blacks of the foreign importers.

The synthetic blacks are confined to those sulphur and direct colors which are cheapest and lend themselves to the easiest method of application. Sulphur blacks give sufficient fastness for all native requirements. Of course, from the nature of the dyehouses no attempts are made to use diazotized and developed colors. A few attempts have been made by progressive native dyehouses in the treaty ports to use Aniline Black, but without much success. The greater care and skill required and the more complicated method of application has not yet found recognition from the consumer in higher prices.

Direct Black, because of the higher cost of the color and the inferior fastness of results, cannot compete with Sulphur Black. At present practically all the Direct Black used is applied to silk.

We find, then, that Sulphur Black is the principal synthetic color used for gray and black on both cotton yarn and piece goods.

Carbon Gray

One interesting method of producing gray on cotton cloth is by impregnating it with carbon. Wood charcoal is ground fine and suspended in water. The piece goods are dipped into this suspension, squeezed, and beaten against a flat stone—driving some of the carbon into the fibers of the material. This treatment is repeated until the desired depth of shade is obtained.

Such a method is restricted to a few localities, and seems sure of replacement eventually by the use of synthetic colors.

Vegetable Black

For Vegetable Black the twigs, bark and acorns of various kinds of oak, the twigs and bark of the chestnut tree and the leaves and twigs of wild tea plants are used as the source of coloring matter. The material depends on what is closest at hand, since such bulky stuff cannot bear heavy transportation charges. The raw material is taken directly to the dyehouse and stored in the courtyard. From time to time portions of the material are broken up, pounded fine and steeped in water. Liquor from this steeping vat is ladled into a larger pot where the material to be dyed is packed.

There seems to be no conscious attempt to "age" the dyewood, but since it is customary to keep several months' supply on hand this function comes about more or less by chance.

The iron mordant is obtained in various ways. In some parts of the country various outcroppings of iron ores are found. Lumps of such material, steeped in water and native vinegar, form a sort of stock vat from which the liquor is taken as required. Where native iron ores are not available scrap iron is steeped in dilute vinegar to make a crude "black liquor."

Tyfical Chinese Dyehouse

Before describing the application of this Vegetable Black in particular we shall give a general description of a Chinese dyehouse or shop, as all colors described later in this article, with the exception of those applied to paper, are applied with but slight modifications in the one type of apparatus used.

The typical dyehouse is entered through one door opening from the narrow village street. The one or two story building fronting on the street is given over to the

(*Continued on page* 770)

Proceedings of the American Association of Textile Chemists and Colorists

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OCTOBER MEETING OF THE NEW YORK SECTION

The October meeting of the New York Section of the American Association of Textile Chemists and Colorists convened at 8.10 o'clock in Stewart's Restaurant, New York City, E. F. L. Lotte presiding as Chairman.

After the regular informal dinner Mr. Lotte introduced the speaker for the evening.

Chairman Lotte—The subject for this evening, as you know, is Textile Trade Waste Disposal. Our first speaker is Mr. Besselievre of the Dorr Company, who has prepared a paper and come here to tell us something of the troubles that we are looking forward to, and some that we are trying to cope with, in the State of New Jersey. If you do not have them in New York yet, probably you will have them later. Mr. Besselievre. (Applause)

TEXTILE WASTES AND STREAM POLLUTION

By E. B. BESSELIEVRE,
Sanitary Engineer, the Dorr Company.

Prevention of pollution of streams is becoming one of the biggest questions of to-day, and undoubtedly there is no more complex problem confronting the engineer charged with the clean-up of a stream than that of handling the wastes from textile mills.

In presenting this paper, the writer will confine his remarks to the treatment of the wastes from mills whose products are fabricated from cotton, wool and silk, and of the wastes incidental to the finishing of these products for final market. As those present are probably all connected with mills of this character, which mills are, in the main, situated in, or adjacent, to the Passaic River in New Jersey, the trend of this paper will be toward a discussion of methods of treatment and requirements for the wastes of those mills discharging into the Passaic River, or its tributaries.

Right at this time, it is timely to state that textile mill wastes cannot be treated by rule-of-thumb methods, nor can methods of treatment be used that are generally satisfactory for the treatment of municipal or domestic sewage. This point must be thoroughly understood and appreciated by the engineer called upon to devise means of treatment, by the manufacturer, and by the municipality. There are records of which the writer is cognizant of plants well designed, well constructed, and properly operated, that have been rendered entirely useless by the inclusion in the sewer flow of the wastes from textile mills.

Let us stop and inquire into the reason for this failure of methods which are eminently successful on sewage.

The first and main difference in the two classes of wastes is that sewage, as we ordinarily speak of it, is the waste carried in the sewers from the sanitary facilities of man, and contains a very small percentage of solid matter, the solid matter being mainly in particles which are clearly visible to the eye; or, at any rate, even if finely divided, they will settle out. These solids are partly inorganic and inert, and partly or-

ganic, and therefore they are subject to decomposition. The organic solids are easily removed by sedimentation, or may be readily oxidized and rendered inoffensive. Sewage contains no noticeable color. The odors and visual nuisance arising from sewage come entirely from the organic solids.

Textile wastes contain practically no visible solids, but do contain a large proportion of solids in solution, and are high in color. Sedimentation has little effect upon textile wastes, and bacterial methods of treatment, which are so generally successful in handling sewage, are usually utter failures because of the bactericidal action of the components of the textile wastes, acids, lime, chlorine, etc.

So with this broad difference in the character of the two wastes, we must approach the problem from an entirely different angle. Not only should the engineer attack the problem with an open mind, but he should be willing to accept the co-operation of the chemist and to make a thorough study of the processes which produce the wastes.

The second important point is that textile waste treatment is not standardized, and to the writer's mind, cannot be. That is, the process worked out and operated successfuly for one textile plant, may fail, or at least be uneconomical for another. Differences in the character of the raw materials, in the dyes, or chemicals, used in the waste of entirely different reactions, from two adjacent plants, although the finished product may seem identical.

Textile waste problems must be considered each as new, and, while what has been done in a similar case before may be used as a guide in devising a general method, careful study, laboratory test and demonstration on samples of the particular waste to be treated should be made. No reliable, economical method of treatment for any textile waste can be evolved otherwise.

The third point to be firmly faced is that, where it is required by law to stop pollution of a stream by textile wastes, the manufacturers concerned must face this requirement as one which can be met, but they must not hope that it can be met profitably to them. Everyone of us knows that there is considerable valuable material being discharged each day, in the wastes from any textile plant: grease, acid, alkali, etc. These have a potential value, as the mill owners buy quantities of raw soaps, acids and alkalis. But there is a long and tortuous path between the potential value of a material contained in the wastes and the terminating point of recovering that material and bringing it to a marketable or usable condition. In traveling that lane much expense is involved, and when we have achieved our pound of grease, alkali, or acid, it is usually from an intrinsic standpoint, a companion of the precious metals or jewels. So let us face the waste treatment problem as that, and put no strong credence in the thought of doing it profitably. The writer does not say that it cannot be done, but, so far, no case has come to his notice where it has been done profitably, nor even economically.

With these thoughts in mind, our problem is to provide a method of treatment that will meet the requirements of the situation, efficiently and economically.

Where the requirement is merely a color-free effluent, to eliminate complaint from visual nuisance, and there is ample space available for treatments units, the treatment should be carried that far only, and units of greater area provided, which, while more costly initially, cost less to operate. The operation, or daily cost, of a waste treatment plant is the item of importance. The writer knows of cases where a few thousand dollars more in initial cost would have saved several dollars per day in operating expense. That several dollars per day is the interest on considerably more than the extra initial investment required.

On the other hand, where not only the color must be removed, but the waste be entirely safe to discharge into a stream that is used for drinking water for humans or animals, the effluent must be neutral. This plant will usually require more complex arrangements, and where the available area for treatment is small, a compact plant is necessary. In this case, the consideration must be to devise a plant that will, on the ground available, produce the desired effluent as economically as possible.

Textile wastes, because of their components, must be treated chemically. Solids and color in solution cannot be removed readily except by the use of precipitants. The plant, therefore, must comprise the units to feed the necessary chemicals in a manner requiring the least manual attention, in volumes found proper and in relation to the flow of waste, and next the units to produce proper admixture of the chemicals with the wastes, to produce quickly the desired reactions, and finally the units required for the quiescent sedimentation of the treated wastes to allow the coagulated solids and color to settle down.

As the human element is notably unreliable, the modern waste treatment plant designer endeavors to eliminate that element as much as possible, yet retaining just enough to assure that the mechanical units are running and are supplied with their proper materials. The entirely mechanically operated plant is successful and has made it possible to do, on a very small area, what it formerly took much space to accomplish. This has been the saving factor for many large plants, called upon to provide works, but whose available land was little. It is always desirable to have the treatment plant as close to

the works as possible, and avoid long travel or pumping of the wastes, which adds to the expense of treatment. Mechanical plants of the modern type make this entirely practicable.

It has been strongly demonstrated that too careful study of all the waste flows from a textile mill cannot be given. While a casual inspection of the waste waters running away from a mill might lead one to say, this may go directly into the stream without treatment, because it is practically clear water, this waste water must be treated. The clear water may be, and usually is, much greater in volume than the colored or objectionable waste, and it would seem offhand uneconomical to treat it. But cases have come before the writer where careful laboratory testing showed that, on the contrary, the reverse was true, namely, that it would materially reduce the cost of treatment if all, or a part, of the clear waters were put through the treatment plant. These clear waters are usually alkaline and the other wastes are frequently highly acid. This acidity, of course, can be neutralized by chemicals, but when it can be done by mixing the acid waste with the proper amount of alkaline waste, why spend money to buy chemicals which are there but for the taking. This procedure may, it is true, entail the construction of a larger plant to handle the increased volume, but, as stated before, a saving of a few dollars per day in cost of operation more than meets the interest cost on the added initial investment. It is not uncommon for textile mill wastes' treatment to cost $20 to $40 per million gallons per day for chemicals alone. Assume that, by making use of the natural reactions between the alkaline and acid wastes, this cost could be reduced one-half, and taking the $20 cost as a basis, this would save $10 per day, which would be $3,000 per year, on a 300-day year. This would be the interest at six per cent on $50,000. Therefore, the owner would be justified in putting that much more in his plant, provided his flow was only one million gallons per day. Many of the larger mills have flows of several million gallons per day, and this economy would rise in increasing ratio as the total volume increased, as initial plant can usually be installed of double or triple size for much less than double or triple cost.

Again, the character of the waste flow from a textile mill changes from hour to hour. At one time the flow may be highly charged with spent dyestuffs, may be highly alkaline or acid, or at another time may be clear and neutral. To attempt to put this flow through a plant as it flowed from the mill would be to keep a force of men on the *qui vive* changing the chemical feed to meet the varying conditions, and would be depending too much on the human element. As the wastes from a textile mill making a standard product are usually the same from day to day, changing perhaps only in the color used, the logical thing to do is to retain the wastes for a day or shorter period, if found satisfactory, in a common basin, allowing them to mingle and the natural reactions to take place; then to discharge these standardized wastes through the treatment plant at a steady rate. By this means, the plant units can be designed to meet the condition of this combined waste and will probably be smaller than if designed to handle the most difficult periodical discharge; the chemical dosage will be simplified, as a steady amount of chemical will be supplied every hour during the flow. This system also simplifies the control, for a system calling for treatment of the individual discharges would require chemical analysis of each different waste, the setting of the chemical dosing appliances to feed the proper amount of chemical for duration of that flow; then when the waste changed, another analysis, another setting of the feeder, and so on throughout the day. Combining wastes entails the construction of two retaining basins, but simplifies plant operation materially.

As textile mill wastes are usually large in volume and the cost of treatment fairly high, it should be borne in mind that the engineer should endeavor to keep that cost down as much as possible. It frequently happens that one chemical or chemical compound seems to be the most suited for a certain waste, but investigation shows that this chemical is high in price and hard to obtain. Tests frequently show that a combination of perhaps two other chemicals will produce the desired result, and while the amounts of each required may be more than for the single chemical, yet the two are often common chemicals, cheap and easily obtained, and the over-all cost much less. When making tests on textile wastes, consideration should be given to trying combinations other than the first successful one, with the view to producing the most economical treatment. Aluminum sulphate, ferrous sulphate and lime are the most easily procured, cheapest, and most easily handled chemicals, and it is usually true that combinations of two or all of these will produce the desired results much cheaper than other single chemicals.

In a recent project under the writer's observation, the wastes in general ran fairly constant during the first four days of the week, but during the last two days a certain department of the mill emptied its dye vats, discharging quantities of spent logwood dyes. These dyes were exceedingly difficult to decolorize, and when combined with the general wastes, made the general cost of treatment jump up to a cost of 6 cents per thousand gallons on these last days, whereas, during the balance of the week the cost was less than 4 cents per thousand gallons, this jump being entirely due to the more detailed treatment required for the logwood dyes. It was developed that these wastes, small in amount, could be treated in a separate plant, the other wastes running through the larger plant. By this means, the general average of the treat-

ment could be kept close to 4.4 cents per thousand gallons over the week, which showed a decided saving over the single plant treating at 4 cents per thousand for the first four days and 6 cents per thousand gallons for the last two days.

To illustrate the difficulty of treating the wastes from a large mill as they flow to the plant, it may be stated that in one case there were twenty-six different pipes or outlets from various parts of a large plant, each discharging a different type, color, or kind of waste. These varied from a flow of 90,000 gallons per hour of one waste, which was found to be beneficial in the treatment, although perfectly clear, to a flow of 2,000 gallons per hour of dye waste from another part of the plant. Ten of these wastes were neutral, three usually alkaline, and three usually acid. Some were always hot, some always cold. It can readily be seen that to treat each of these separately would be an endless job of control and extensive plant. By combining them, holding the various flows to get the natural reactions, it was found that, of a total flow of over 440,000 gallons per hour, 189,000 gallons were wastes requiring treatment; 125,000 did not require treatment, but were beneficial in mixing with the others to reduce the cost of treatment, and 125,000 gallons could be discharged to the river without any treatment.

The plant for treating the combined flow of wastes requiring treatment and those beneficial would occupy a total space about 500 feet long by 200 feet wide. Outside of chemicals the cost of operation of this plant would be about $12 per 10-hour day, assuming a cost of 6 cents per kilowatt hour for electrical current.

In all waste treatment plants the chemical precipitation produces a voluminous sludge which must be removed from the tanks or, if allowed to remain in them, will gradually fill them up, causing deterioration of the effluent by reduction of sedimentation space, necessitating the construction of duplicate tanks for use when these others are being emptied. Cleaning of sludge has therefore been a troublesome manual operation, requiring the use of much labor and water, and either interrupting the plant or requiring duplicate tanks. Recently a unit has been perfected which eliminates these troubles. This unit comprises a mechanical sludge collecting mechanism installed in a simple, square tank of the proper size. This mechanism slowly revolves, and by means of small rakes or plows on the four arms collects the sludge that has settled on any part of the bottom of the tank and carries it down the sloping bottom to a common point from where it is removed through suitable sludge pipes by gravity or by pump. This mechanism, as well as collecting the sludge, actually concentrates it by its action in rolling the solid particles down the slope and by a slight squeezing action, so that the resultant sludge from this type of unit is lower in moisture than from the ordinary sedimentation unit. This means less sludge to handle and less expense for operation, sludge drying beds, etc.

This unit also by collecting the sludge continuously eliminates the need for deep tanks and also makes needless the duplicate tank. Many installations of this type of unit have been made in industrial wastes' treatment, sewage and water treatment plants in the United States and in Canada, and there are several plants now in course of construction and operation in the Passaic Valley District.

The primary factors to be remembered in considering the treatment of textile mill wastes are the need for careful study of the particular problem, intelligent and careful design, taking advantage of all natural elements to reduce operating cost, and making use of natural reactions, thus providing a plant that will reduce manual attention and control to the minimum.

The plant chemist, with his valuable knowledge of the various processes and programs of manufacture, can be of valuable assistance to the engineer called in to devise a treatment plant, and he should be called in to co-operate with any engineer selected, and his recommendations and advice should be given the careful consideration it deserves. Those who are experienced in the treatment of a variety of trade wastes and are familiar with the equipment used in such plants are sometimes better equipped to apply this general knowledge to a problem to the best advantage, but on the other hand they do not always have the necessary information about chemical processes and resultant waste flows. Then the plant chemist is concerned with his local problems and cannot be expected to be fully informed on the most modern ideas and methods used in the general sanitary engineering field. The best combination, therefore, to investigate a trade waste problem and devise a successful, economical solution, is that of the plant chemist and a sanitary engineer, or engineering firm whose work has shown that it is conversant with the practice in various fields and is competent to investigate, test, and devise the necessary method and plant to carry out the proposed treatment.

A few dollars spent in this help, for the plant chemist will usually pay substantial dividends in giving him the advantage of the best practice, and in producing for his company the most economical plant. The engineer who regards his ethics as next to his religion will co-operate to the fullest degree with his client in producing the most economical plant, regardless of its initial cost, his fee, in his mind, being the secondary consideration.

Successful plants for treating the wastes from mills making fabrics from silk, cotton and wool have been devised, and numbers of them will be installed and successfully operated, but too great stress cannot be laid upon the fact that the method of treatment worked out at one mill may not work at another mill of apparently the same

type. Stress should also be laid upon the fact that, while experimental plants may sometimes seem advisable, they are usually expensive playthings, and while it may seem possible to cut down the initial cost of a proper treatment plant, it frequently happens that, after experimentation, the fact remains that the plant originally proposed is the right one after all.

Discussion of Textile Waste Disposal

Chairman Lotte—Is there anyone who wants to ask Mr. Besselievre any questions?

We have others here to-night who should be able to speak on the subject. We have Mr. Zillessen with us. Probably he would like to say a word while others are getting ready to ask questions and discuss the paper.

(Mr. Zillessen stated he did not have any comments to make on the paper presented.)

Chairman Lotte—We would be glad to have Mr. Knight say something.

Mr. Knight—I am a contentious cuss, and I am always taking the offside of every question. In all due deference to Mr. Besselievre, I want to take exception to one or two things that he said in his paper.

I am led to believe, from what I have heard here to-night, that the gospel I have been preaching is all wrong; that it does not pay to try to recover by-products. Maybe I am carrying that too far. We know that the inherent values in waste cost so much to take out, to market, to handle, that in most cases in these days and times, especially with low prices, it is hardly worth the effort, but I want to call your attention to a situation in the Passaic Valley which is comparable with the situation on the continent and in England, where for many years, by force of circumstances, for reasons of economy, by reason of a law enactment as a defense measure, they have had to conserve.

I have frequently said—and I think I am right—that we are the greatest wasters in the world. From the time this country was a youngster, we have felled our trees, picked off what we wanted, and let it waste. With all our resources we have done the same thing. It is characteristic of the American to pick out only the cream of things, to take only that which is most valuable, and throw the rest away; we all recognize the truth of that. We are a young country with boundless resources, and it does seem as if now that we have a penalty to pay in the Passaic Valley in that we must stop polluting the river, in that all river discharges of polluting character are illegal; now that we have a $22,000,000 sewer provided for the removal of mill waste as well as sanitary sewage, we ought to attempt at any rate to see what there is in waste values that is recoverable from a practical standpoint.

Mr. Zillessen, to whom reference was made, is making his living—perhaps not a substantial one, perhaps not as good a one as he expects to make later—but anyway he thinks enough of the thing to have attempted to market some of the by-products from mill waste. Mr. Zillessen is not a dreamer. For twenty years Mr. Zillessen was the chief chemist and dyer in one of the largest dyeing houses in the valley, the United Piece Dye Works. No one need be told what outfit that is. For twenty years Mr. Zillessen occupied the position of research chemist, and he discovered in his labors that it was profitable to save the boil-off liquors for the purpose of getting out the grease for making soap. So that we have not only someone's "think-so" that it is possible to extract values, but here is a man who is making his living out of it.

Let us take the situation in England with regard to wool scouring. I refer particularly to the Bradford Mills. Most of the men here who are familiar with the wool scouring industry know that it is practically possible, or that it has been made possible, to obtain not only greases but potash salts from the wool waste, the wool suds. It hasn't been largely attempted here. In this country we take the cream; I mention again, the cream of things is taken out here.

Take the Botany Mills in Passaic: they have a huge battery of separators that take out the most valuable of the by-products. It hasn't been necessary heretofore to carry this by-product recovery to any lengths because we had the river to discharge into. Up to August 2nd of this year it was considered the proper thing to do to use the river to discharge waste into. From an esthetic standpoint it wasn't a nice thing to do, but the river was handy. Now we have come upon a time when it is no longer possible to do that, and in my research work in connection with that I am very frank to say I found it practically possible, through the use of common sense, to put in a recovery plant or an installation for by-product recovery that means a saving. It means just this: that treatment for breaking down waste plus treatment for by-product recovery, minus what you can get back for your by-products, is less in a total sum than you would spend for a removal plant alone. I am convinced that I am right in that, and one of my clients has enough confidence in me to let me go ahead on that basis.

I speak of that for this reason (I said before I was a contentious cuss): we have no reason for not trying to see what can be done practically along that line. This is a new situation, but it is one that is absolutely comparable with the situation abroad. Why then is it not practical and possible to carry your research work to such a point as will demonstrate whether or not it is possible to do that, gentlemen?

I thank you. (Applause.)

Chairman Lotte—We will be glad to hear from anyone else who wishes to discuss this subject or to say a word along these lines.

Mr. Besselievre—In answer to Mr. Knight, I believe I said in my paper that the manufacturers must consider the problem from a waste treatment standpoint. I didn't say that it had not been done, that waste could not be recovered in valuable products; I said I didn't know of any cases where it had been economically done or profitably done, and my object was to call attention to the fact that the manufacturer must not be misled into believing he could accomplish this waste treatment and put money back into his pocket, but must attack it from the standpoint of a problem to be met from humanitarian purposes and go at it in that way. If he can recover something, well and good; the more he can recover, the better. But I don't believe he should look at the problem from that angle primarily.

Mr. Knight—That is right.

Chairman Lotte—Are there any others, gentlemen? We would be glad to hear from you because we have been accused of indifference to the subject; in fact, Mr. Grandage said that probably some of the New York Section wouldn't be as vitally interested in this as we would be. It does look as though we have made this a Jersey night, but you will have to forgive us if a good many of us are Jersey men, and if we are talking along Jersey lines to-night; but we would be glad to hear from you and to have you say something with us who are in Jersey and along the Passaic Valley. It is a sort of nightmare to us to know exactly what to do. We have not come to the point where we felt we were able to handle waste disposal from an economical or profitable standpoint, and we have quite a good bit of waste to handle; in fact, some of the figures that were given us by engineers almost staggered us, and if we can come to a point where we can handle the trade wastes, even if they cost us something, we would be willing to do it, and we are working on it and spending money in research and trying to get all the help we can to do it. Therefore, we would be glad to have you here to-night, who know something of it, say a word or help us along, because I believe that this organization is for that purpose, in order that we may discuss our problems and help one another. Even though we do come in competition in other lines we are here to help, and if there is a word that can be said, I am sure that this organization will be the better for it and you and we will all feel better for it.

Mr. Jones—With regard to Mr. Knight's remarks about the treatment of wool scouring waste in particular, I would like to ask him if he has any idea about the quantity that it would be partly profitable to handle with regard to the recovery of the fats. Of course, I suppose that depends on the quantity handled.

Mr. Knight—I should say offhand that a minimum flow of 50,000 gallons or between 40,000 and 50,000 gallons would be the beginning of economical work for recovery.

Mr. Jones—With less than that you would simply treat it as a purification problem?

Mr. Knight—Well, it is on the dividing line.

Chairman Lotte—Isn't it true, too, Mr. Knight, that greases and oils are really the most profitable thing; that is, the other wastes that you have are quite difficult to handle and handle properly?

Mr. Knight—Yes, conditions in this country do not warrant us in going after the other at the present time. In Europe and in England they do recover much more. They fairly polish the waste, in order to get results. Here our market conditions and our labor conditions enter into it, and it is not profitable to go after everything.

Mr. Jones—They do handle it on a sort of co-operative system as well?

Mr. Knight—Yes.

Chairman Lotte—Your colors in your waste make it much more difficult to handle because in your colors you have very little that is profitable to recover.

Mr. Knight—There is nothing at all to recover.

Chairman Lotte—And because your dyers take out nearly all the color, they try to extract everything that they can.

Mr. Knight—Yes, it is all spent color.

Chairman Lotte—It is spent color that it does not pay to recover, and that is really one of the most expensive things you have got to recover, isn't it?

Mr. Knight—Yes, sir.

Chairman Lotte—Has anyone here any figures that they could give us about what it costs? You spoke about a 10,000,000-gallon plant.

Mr. Bessclievre—The cost of the plant?

Chairman Lotte—The cost per millions of gallons.

Mr. Besselievre—The cost per million gallons of that plant was $40. That is the cost for treatment alone, exclusive of the cost of the plant. That was *chemical* cost, I should say. The cost for electric current of that plant to operate the different units would probably run about $12 a day; the treatment cost would run about $40 per million, and the installation cost of that plant I described would probably be close to $200,000 ready to operate.

Chairman Lotte—Then to your $40 and $12 you would have to add your depreciation and interest on your capital.

Mr. Besselievre—Oh, yes. So that it would make quite a tremendously expensive proposition for a flow of that size.

Chairman Lotte—I am thinking of it from the view of one in competition with people who may not have to do it; that is, with reference to conditions such as exist in the Blackstone Valley. I understand that has legally been made a sewer. (Laughter.)

Mr. Besselievre—In Rhode Island? Yes, that is true.

Chairman Lotte—Thus, one working in New Jersey would be in competition with people who could legally allow their waste to run into a river, so that the difference in cost would be charged up against the Jersey goods, and they would have that much harder competition than one in the Blackstone River Valley.

Mr. Besselievre—Absolutely.

Mr. Wood—Mr. Chairman, I happen to be the chairman of the Dyers' Conference Committee, which is now carrying on conferences with the authorities of the city of Paterson, and it might interest these gentlemen to know something about the conditions we are up against in Jersey, and particularly in the city of Paterson.

The trunk sewer, when it was built, was supposed to take care of the sewage of all the municipalities that wished to enter into it in the Passaic Valley. The quota of the city of Paterson was, I think, 64,000,000 gallons, when the sewer was first contemplated, and by the selling of certain parts of their rights to surrounding municipalities, they brought this down to 56,000,000 gallons, which is the quota apportioned to the city of Paterson to-day, and that quota is supposed to be taken in ten years' time. To-day we are putting into the sewer, by actual measure, 30,000,000 gallons of waste matter. When the Sewer Commission first brought up the subject, they figured that they could dispose of the sewage at a cost of from $6 to $7 per million gallons. To-day they tell us that the cost will be $30 per million gallons—a slight discrepancy. The proposal which I have in my pocket now for consideration at the conference next Monday with the city authorities (the proposal that the city of Paterson now makes to the dyers) is that they shall be allowed 100 gallons per employee, which I believe is the usual quota allowed in domestic sewage, the average unit of population. We don't think that is enough. They want us to pay for any amount above that at the rate of $30 per million gallons.

Now, as the dyers of Paterson procure water from the dyers' pipe at a cost of from $15 to $18 per million gallons, you will see that the water is going to cost them $18 per million when it is cleaned and $30 a million when it is dirty, which looks rather hard. (Laughter.) You can well imagine that the dyers of Paterson don't look very favorably on this plan; so on Monday we have a battle before us.

Of course, the subject has had a good deal of thought on both sides. The city wants to do the fair thing by such an important industry, and the industry wants to do the fair thing by the city. The Passaic River, as most of you know, hasn't been very—what shall we call it?—salubrious for many years. I remember that when I first went to Paterson over twenty years ago it was just about as dirty as it is to-day; in fact, dirtier, I think; everybody was busier, although probably there weren't so many dyers in the town. The problem has been complicated somewhat by the fact that the city of Paterson is putting into the sewer some millions of gallons of surface water, storm water, which very properly should be returned to the river, and that is in consequence of the fact that the city fathers in times past (God bless their memory) have never faced this problem and provided for the storm water. At that rate they are going to pay $30 a million gallons for perfectly clean water that is going into the sewer. There is one condition that the dyers can't remedy, that the city can and must, and I suppose will. But, of course, it is a very expensive proposition to resewer all the streets and divide the surface water from the common sewage.

Now, the result of this condition is that the inland dyers, as I call them—those who are away from the river bank—have no means, even were they to undertake to divide their sewage and separate the clean water from the polluted water, of turning that clear water back into the river.

So much for the conditions in the city of Paterson. We are not asking for sympathy, but it might interest you to know just exactly what we are up against.

Just a word with regard to the remarks of the speakers who have favored us so far. In the first place, I do think—we talk of unmixed blessings, and I will coin a phrase from that—I do think that this regulation of sewage isn't going to be an unmixed curse, because I think it will be necessary for every dyer to be a little more economical in the use of water, and that will undoubtedly reduce his water bill and certainly reduce his sewage bill.

We shall probably devise means—and no doubt these gentlemen who are experts on this subject have thought of this—of using certain waters which are clear, over and over again until they become thoroughly polluted. In that way we can reduce the volume of the sewage. It is quite conceivable, for instance, that we can take the first wash waters from the boiler for the scouring and use those over again for the actual boil-off or scouring operation. Then Mr. Zillessen's fine work comes in, and we shall take those scouring liquors when they are thoroughly polluted, crack them, clarify them and take out the grease, and we will have a reduced quantity of sewage from that source and a very much clearer sewage.

More than twenty years ago I tried to perform that

very operation in the works of the American Silk Dyeing & Finishing Company, now the Hawthorne branch of the United Piece Dye Works, and quite successfully, although in those days there wasn't the stimulus that there is nowadays. In those days I think we paid 4¾ cents a pound for olive oil soap, whereas to-day we pay twice that.

The method used was simply to pump up the liquors into a tank, crack them, pass out the clear water, and filter off the magma formed and work it up again into soap, and that soap positively could not be used for the boil-off operation because of the sericin or silk glue. It was used for the logwood black dyeing. I think they have been doing that for years in the Weidmann plant, also connected with the United.

I think it was Mr. Knight who referred to the great progress which has been made in the recovery of by-products abroad, and I think he mentioned the Continent and England. I don't know that it is quite so noteworthy in England; it may be nowadays, but it certainly wasn't in days gone by, as it was particularly in Germany. I think Germany stood first among the countries that were economically minded enough to take care of their by-products of every kind. You can see evidence of the thriftiness of these Continental peoples in the way they use their land. You find there are no hedges between the fields; there are no stone walls —they use every inch for raising grass or crops, or whatever they want to raise; in England it is a little different, although, of course, England is well cultivated, but the parallel in business is exactly the same. There is meticulous care exercised in recovering by-products in Germany, a little less so in France, and much less in England.

The rivers of England will tell you, both visibly and nasally, that they are far from being pure. I remember—it must have been some time before I was born (laughter)—that there was a royal commission appointed to clarify the waters of the River Aire, into which Bradford discharges its sewage, and that commission met and suggested laws which were afterwards passed—and I think it is safe to say that you could almost walk dryshod across the surface of the River Aire to-day. It does just move; you can see the water moving, but it is very, very thick (laughter), and if they recover anything in Bradford to-day from waste water there must be a great deal more that they could recover if they tried. I do happen to know that as far back as twenty-five years ago in the city of Wakefield, which is also a woolen center, in one of the largest woolen skein dye houses there, they were recovering their soap fats. I remember that the process was very thorough. They used to take the liquors and crack them in camel's-hair bags—I am just giving you these details to illustrate to you how thoroughly they go into the matter of recovery—the liquor was cracked and I think the clear liquors were concentrated for the potash salts and sent away to be refined; the fats were filtered in camel's-hair bags and hot-pressed in ovens; when the fat was heated, of course it melted and ran out and was collected and worked up into soap or used for other purpose, and the camel's-hair bags were sent away to be made up into shoddy for making clothing. So there wasn't very much that they lost out of their by-products there; in fact, they told me that that really made them their dividends.

One thing that hasn't been stressed sufficiently this evening is the matter of co-operative action, both in reclaiming by-products and in disposal of waste matters. I think Mr. Zillessen is making a pioneer step in this direction by getting together as many manufacturers as he can to put together all their waste, which he will recover—and I wish him success in his enterprise; I believe that we can go still further and really make something out of what looks at the present like a very bad job.

Mr. Knight—May I say one more word? If we have been an uneconomical people—even our highbrows in the laboratory and on the engineering staffs—in wasting heretofore, it is going to be doubly necessary for us now to watch every dollar that is thrown down the sewer.

Mr. Van Dyne, the chief engineer of the Passaic Valley Sewerage Commission (this may interest you New York folks), made the statement just prior to the opening of the sewer, when it was estimated that the cost of handling, pumping and treating the sewage would run between $6.50 and $7 per day, that it would be economically possible for a manufacturer to spend up to $42,000 per million to keep sewage from going into the sewer. If it is going to cost between $20 and $30 per million per day, it doesn't take much of a mathematician to see that it would be economically possible for a manufacturer to spend up to $180,000 per million gallons to keep it from going into the sewer. That is a tremendous investment; but stop and think of the importance of those figures! It has no other objective, when you stop to reason the thing out, than that if it is practically possible to extract values from your waste it should be done. It is the duty of every chemist and every engineer of these industries to see what there is along that line that can be done.

Dr. Snell—Mr. Chairman, what I have to say is more or less a continuation of what Mr. Wood has already said, and it refers directly and is a repetition of what Mr. Besselievre has already said. He called your attention to the fact that it takes a different type of treatment for treating sewage than it does for treat-

ing industrial wastes, such as dye baths. This proposal which has been made in Paterson to allow dye waste and material of that sort to go into the sewer, metered at a certain charge, it seems to me from the chemical point of view, is an exact case of putting material which requires one kind of treatment into a plant designed for a different type of work. That plant down in the New Jersey meadows is a sedimentation plant which is designed to settle out the solid material and in that way obtain a clear affluent and let it go out into New York Bay.

Naturally, I am not saying that a few dye baths going into the sewers of Paterson are going to color that affluent so that they will color up all of New York Bay, but if Paterson adopts that method of disposing of its dye baths there is no reason why Passaic and Belleville and all the rest of the places should not do the same, and I do believe that if the discharge of dye baths into the sewer were a general thing the plant on the New Jersey meadows would not operate properly for the removal of the considerable quantities of color which would thus be discharged.

Mr. Hadley—Do I understand that the city of Paterson is going to be allowed to empty all its trade waste into the sewer without treatment—10 per cent, isn't it, that is allowed to go in?

Mr. Wood—No, they won't take all the sewage of the dyers; that is another point that we have to consider, that I probably overlooked when I was talking. I think it is 10 per cent at present. I don't know whether or not that quota can be lived up to by any industrial plant, but as much as possible of the clear water must be turned back into the river because naturally they don't want the dry bed of a river there. (Laughter.)

Now I would like to answer a point that you brought up. These gentlemen have told us that a lot of the chemicals discharged from the different works would mutually react with one another and would probably produce this precipitation and coagulation which is so much to be desired. So I really think that the amount of dyestuffs discharged into the sewer by the dyers of Paterson, Passaic or anybody along the route would practically be negligible, and as a matter of fact I don't think the color would be the item that would bother them at all. So far as I can see, if we just discharge a small quantity of the most highly colored soluble waste, that wouldn't be a problem at all for the sewer, because while it is true that they could not remove it by sedimentation, there would be no object in removing it all, because that amount would be lost when it got into New York Bay.

Prof. Jackson—Mr. Chairman, there are quite a number of problems connected with the municipal treatment of wastes which are quite aside from the industrial treatment of waste. The first real problem of that kind in this country was in Worcester, Mass., where the industrial wastes are very heavy, particularly in the Washburn & Moen Iron Works, where they discharge enormous amounts of sulphuric acid and iron into the city sewers. That involved the problem of making a separate system of sewers for the city of Worcester, which is a matter that should be considered in any city where industrial wastes are heavy, because it is very much cheaper to put in separate systems of sewers to take care of the storm water and then treat the industrial wastes in a more concentrated way to better advantage. That was done. Also the acid was neutralized in tanks, thereby bringing down the hydrate of iron which served as a precipitant, so that the lime and iron reacted, and for a good many years that was the treatment in the city of Worcester.

There is a great deal of talk about the enormous amount of waste that is going on in the disposal of city wastes, in money values. Much of that is all bosh. There isn't anything to it.

I have visited plants of this character all over the United States and Germany and England and France, and I visited a good many plants where it was claimed in engineering journals that they were making great savings by these complicated systems of disposal. For instance, in the city of Dresden, where it was required that all the solid matter be removed beyond the point of three millimeters in the city wastes there, involving the use of screens for that purpose, they took out a very large amount of waste; this waste was dried and treated with gasoline and a large recovery of oils or soap could be made in that way, taking out the oil after the evaporation of solid matter, which was then available for agricultural purposes and fertilizer; and the engineering journals that year told how much money was being saved by the city of Dresden on this sewage-promoting plant, which was true; they made quite a little money on it the first year; the farmers paid considerable money for this dried waste, and they made a good deal on the recovery of the fats. The second year, however, the farmers were loath to take it away; they had an excess of it; it had to be carried longer distances; and by the third year they had to *pay* to take it away. In other words, the supply was so much greater than the local demand for fertilizer that it didn't work out. And that has been the case with a great many of these foreign plants which you hear about as recovering so much money values from waste disposal of that character.

There isn't any question but that the recovery of greases or fats and oils, as Mr. Knight has pointed out, is a valuable thing and it may in some cases be sufficiently valuable to perhaps counteract the cost of recovery. It

certainly will help to counteract the expense of the operation of such a plant. That it will do; but to expect large money values from the usual drainage in plants is hardly to be thought of.

Sometimes people bring up the question of why we don't dispose of our sewage here in New York City or in the Passaic Valley on large tracts of land, for fertilizing purposes, on big agricultural tracts, such as they have in the vicinity of Berlin and Paris. You must remember that Berlin and Paris have got to dispose of their sewage that way; they are on small streams; they can't get rid of it as we do here in our enormous width of surrounding water. We have a tremendous asset for the disposal of waste which will last for some considerable time yet and which is actually worth hundreds of millions of dollars to us. There may come a time when we will be obliged to do it in some other way, and perhaps some recovery of that kind will be brought about, although probably it will be sent to sea.

The point I want to emphasize is, that in order to get recoveries properly from factory wastes it is necessary to have concentrated wastes and not to have them filled with storm waters and other diluting waters where it is possible to separate them. Also, as was pointed out, you don't want the dry bed of a stream. So that these cities that have large factory wastes and are putting their storm waters in at the same time should naturally separate those waters; even if the initial expense is considerable, you save a great deal in the long run, and neither should that be a charge against the factories themselves. The normal amount of drainage which they should be allowed to put in will be reduced to that extent, and the treatment down below will probably be taken care of, because after all the most economical and best way to treat drainage of any kind is by dilution if it is possible to do it. By this enormous dilution of these color wastes which we normally get in the Passaic Valley, they would be lost in the shuffle, so to speak, and the treatment would probably be satisfactory because of the high dilutions.

Mr. Hadley—Prof. Jackson's remarks upon the substances reclaimed in Europe being a drug on the market reminds me that a number of years ago the woolen mills along the Mamaroneck Valley did a good deal to recover the wool grease, and I was informed two or three months ago that at least some of those recovery plants were absolutely idle for some time and that they would be glad to dispose of the wool grease they had collected for some years past; that the market was not there for disposing of those recovery products at the present time.

Prof. Jackson—I don't want to convey the impression that the fats and greases should not be taken out of sewers. I think that is a point which ought to be stressed and I might say that in Germany it is a requirement; in fact, even the restaurants have tanks in which the liquid flows over and the grease rises in these tanks, and then the rest of the liquid passes on. Any large amount of grease should be taken out of the sewer, and I think that the authorities should oblige the manufacturers to remove any abnormal amount of grease. At the same time an abnormal amount of grease will pay for itself in actual value. But outside of that grease element (and that is one to be considered from an economic point of view), and regarding the recovery of other elements such as might be put toward fertilizer, except in very special cases, it is very much better to throw it away diluted and get rid of it if possible.

Mr. Besselievre—Along the line that Prof. Jackson has pursued, the city of Milwaukee has just completed a sewage plant to treat the entire sewage of that city. A system was brought out about ten years ago which so far is recognized as about the most efficient system of sewage treatment. That was the process of agitating the sewage in the presence of air and getting rapid oxidation and complete stability in that way. One of the fundamental principles of the system as worked out at first was that the sludge from the system had a high potential value as a fertilizer ingredient; it was rich in nitrates, and the system immediately took hold because the plant ostensibly would pay for itself. Milwaukee has spent to date about $15,000,000 building this plant. At the present time they are putting in probably $1,000,000 worth of equipment to reduce the sludge from 99 per cent water to 10 per cent water, to get it down on a basis on which they can use it commercially, and as yet they don't know where they are going to market the product when they get through, so they have spent the money and have arrived nowhere at the present time.

The city of Chicago is now building a large plant which will cost probably $30,000,000 before they are through with it, on the same type of treatment, simply because that type of plant occupies less ground area than any other sewage plant ever devised. Instead of providing all the equipment for dewatering the sludge, they are forgetting that point entirely and are going to pump the sludge to some lowland and let it fill up in that section. They are not going to spend the money of the city of Chicago to try to dewater something which has no market after you get it dewatered. They have found, after experimentation, that that sludge is good as a fertilizer. They have tried it on the golf course, and in the opinion of one experimenter that seems to be a fertile field. The answer to the problem seems to be to build as many golf courses as possible to use the product from the sewage plant. (Laughter.) It is a vicious cycle, and the city of Chicago has realized that it cannot make money from building that sewage plant. They get a beautiful product and fine fertilizer, but they cannot get rid of it. The farmers will take it but they won't pay for it. (Laughter.)

So the situation is pretty nearly the same in the trade waste field in general. You cannot afford usually, at the present time at least, to recover valuable products from it.

In that connection I visited, about two years ago, a plant just outside of Boston, a sheepskin tannery, where they got the raw fleece and got a lot of wool grease, as they do in these plants here. They had put in a plant to recover the grease. That plant, they said, during the war practically paid for its operation, but at the time I saw it it was not paying for its own operation. They were recovering that grease simply to keep it out of the rest of the sewage more than for any other reason. The plant itself was not economical nor a profit in any way whatsoever, and I think that has been the experience not only at that plant but at some others where they have installed expensive pieces of apparatus to recover products; they finally use them because it helps in their treatment problem, but not otherwise.

Chairman Lotte—Does Milwaukee take all her waste, Mr. Besselievre?

Mr. Besselievre—No, only sanitary sewage.

Chairman Lotte—There are no cities that take in industrial wastes as well as sanitary, Mr. Besselievre?

Mr. Besselievre—Yes, there are; but as I explained before, the action of the industrial waste is to prevent the beneficial action of the sewage treatment works and they keep it out if possible, where they have sewage treatment works; that is, where they know what they are up against. An example of that was at Phillipsburg, N. J., where they installed quite an elaborate plant some years ago; it was a plant involving lime precipitation and electrolytic action following the precipitation. They had a dye waste come into the sewer above that plant, and you could go there on any day and see the final settling tank of the plant after it had been through the lime-treating units and electrolyzers; you could follow the progress in the dye plant above by the different strata of colors in the sedimentation basis, going right through and down the river. The government made them stop that and made them put in a plant to treat the waste before it was discharged into the city sewer, because the sewage plant was being rendered absolutely ineffective by that action.

Mr. Schroeder—Have they had septic tanks?

Mr. Besselievre—That was direct oxidation. We have had several cases called to our attention recently from the South—South Carolina and Georgia—where towns have had septic tanks, or Imhoff tanks, one of the latest approved types of plants, which have had to be put out of operation because the trade wastes were being put in there and there was no beneficial effect from the plant at all; they simply by-passed the whole plant into the river; the investment has been scrapped, and the plant is lying there idle. I know of two particular cases where that is true.

Chairman Lotte—If there are any other questions you would like to discuss, we should be glad to hear from others because you can see that it is vitally interesting not only to Jersey but apparently it has been interesting to other municipalities and other States as well. It looks as though we might be called to account even in New York Bay for sending a little dyestuff down there.

Mr. Knight—I move that we adjourn.

. . . The motion was regularly seconded and carried, and the meeting adjourned at 9.25 o'clock. . . .

OCTOBER MEETING OF THE NORTHERN NEW ENGLAND SECTION

The first meeting of the season of the Northern New England Section of the American Association of Textile Chemists and Colorists was held on October 25, 1924, at the Lowell Textile School. About seventy-seven members and guests were present when the Chairman, John F. Bannan, called the meeting to order at 5.30 p. m. Dinner was served in the school auditorium. The atmosphere of sociability and interest contributed much toward the success of the meeting.

It is to be regretted that the group photograph taken during the dinner was not satisfactory.

After the dinner the gathering adjourned to the chemical lecture room of the school, where Harry R. Davies and Dr. H. C. Chapin presented two very instructive papers. The great interest in the subjects of both papers, published herewith, was made manifest in the discussion that followed their presentation.

A. K. Johnson, Secretary.

THE DYEING OF CELLULOSE ACETATE SILK

By Harry R. Davies
Dyestuffs Corporation of America

Cellulose acetate silk is perhaps better known by its trade names, "Lustron Silk" and "Celanese Silk." "Lustron" is made in Boston by the Lustron Company and was the subject of a paper read at the last annual meeting. "Celanese" is the trade-mark and the registered names of the product made by the British Celanese, Ltd., and the American Cellulose & Chemical Manufacturing Company. Celanese, though similar chemically to Lustron, is not identical in its properties.

Hitherto all the Celanese used in this country has been of British manufacture, but the American company's plant in Maryland is now in operation and will very shortly be producing Celanese in a large variety of deniers ranging from 45 to 300.

The older forms of artificial silk, such as viscose and the various nitro silks, offer no particular difficulty to

the dyer in so far as choice of color is concerned. They all consist, like cotton, essentially of cellulose, perhaps of varying degrees of hydration, and they are all readily dyed with the complete range of dyestuffs used for cotton dyeing, with only such precautions as are necessary to obtain level results. In other words, with all of the artificial silks, other than acetate silk, the proper selection of dyestuffs from an already established range of cotton dyes readily solves most problems.

In the last four or five years acetate silks have become of increasing prominence due to the successful conversion of factories, which were established for the manufacture of acetyl cellulose, for use in the making of "dope" for airplane wings. This attempt to find a peace-time outlet for a war product has resulted first in the mercantile adoption of a new fiber, and more recently in the development of new types of dyestuffs for its coloring, made as the result of intensive research work by the large dyestuff manufacturers and also by the manufacturers of the silk.

Acetate silk has a beauty and strength more nearly like that of real silk than any other artificial variety. It is, of course, not silk and does not behave like silk, any more than it behaves like viscose silk or the other regenerated celluloses; so far as dyeing is concerned, acetate silk must be regarded as an entirely new fiber with its own distinct properties and its own peculiar problems.

The difficulties which have been encountered in trying to successfully dye acetate silk center around the fact that of all fibers in general use it possesses the least affinity for dyestuffs. It is not definitely established why this should be so, but it is true that the acetate silks are much more resistant to wetting out and absorb water much less readily than other fibers. It is assumed by many, therefore, that the physical characteristics of the fiber rather than its chemical nature are responsible for its dyeing behavior. On the other hand, the chemical nature of acetate silk has undoubtedly something to do with the problem.

If we examine briefly the behavior of the various well-known types of dyestuffs we find but few which can be considered as wholly satisfactory dyeing materials for Celanese and other acetate silks.

The direct cotton colors as a class have practically no affinity at all for Celanese. In fact, one of the earliest uses of acetate silk was in the production of resist stripe effects. Over fifteen years ago acetylated cotton was experimented with by one or two mills in New England with the object in view of producing a resist stripe in cotton and union goods which were piece-dyed with direct cotton colors.

Lustron and Celanese silk have successfully replaced acetylated cotton for this purpose, and hundreds of thousands of yards of union fabrics with acetate silk effect threads are to-day dyed by this process. It cannot be said, however, that any direct cotton color can be used for this purpose, because impurities generally present and incidental to the manufacture of certain direct cotton dyes readily stain acetate silk. It is, therefore, advisable where acetate silks are used for this class of work to select those dyes for the cotton and wool such as the C. R. or Celanese Resist Dianol and Chlorazol colors which are recommended by the manufacturer and which are especially standardized with the object of leaving the acetate silk unstained.

The acid colors, as a class, do not dye acetate silk. There are, however, exceptions to this rule. Certain colors, such as Citronine, Azo Acid Yellow, several of the Cloth Reds, Metanil Yellow and others will materially dye acetate silks. However, the absorption of the dye is rarely complete. Dye baths are difficult to exhaust, full shades are almost impossible of attainment, and there is a lack of a complete range of colors which makes it impossible for the dyer to produce all the effects he desires by a sole dependency on acid colors.

Among the basic colors are found those dyestuffs which of the older types best dye acetate silks. Practically all of the basic dyes will color acetate silk. It might be well to mention, however, that the different acetate silks behave quite differently in their affinity for basic dyes. Lustron silk undoubtedly dyes much more readily with basic dyes than does Celanese, and this, from a dyeing standpoint, may be regarded as the principal difference between the two fibers. Not all the basic dyes really produce good full shades. The Rhodamines, Brilliant and Malachite Green, Methylene Green, Acridine Orange, Magenta, Chrysoidine and Capri Blue are among the best basic dyes. Methylene Blue is not so good, inasmuch as it has little affinity and is not fast. It is interesting to note that Magenta is very much faster both to washing and to light on acetate silk than it is on any of the older fibers.

Many of the chrome colors, such as the Alizarine Blues, Prune Pure and Anthracene Brown, possess fairly good affinity for Celanese and Lustron silks; an affinity, however, which differs with the different silks. Here again, however, there is a difficulty of obtaining complete exhaustion and heavy shades. Acetate silk has no affinity for mordants of a metallic nature or for tannic acid, so that it cannot be dyed by a two-bath method dependent on the prior application of a mordant. The chrome colors which have an affinity for

acetate silk can, however, be generally improved in fastness by an after-treatment with chrome.

Acetate silks can be dyed with vat dyes especially of the Indigoid type, but it is a matter of some difficulty. A very careful adjustment of alkali and hydrosulphite is necessary, and dyeings show a tendency to rub badly.

Sulphur colors can be used for the dyeing of acetate silks, but only by sacrificing both the weight and, to some extent, the valuable properties of the fiber. Cellulose acetate on treatment with alkalies at elevated temperatures is saponified, losing up to 10 per cent of its weight and the distinctive properties of cellulose acetate. It thus becomes a regenerated cellulose and as such can be readily dyed with both direct cotton colors and sulphur colors. In other words, saponified acetate silk behaves practically the same as the other artificial silks. It will thus be seen that sulphur colors which are dyed from a strongly alkaline bath at high temperatures will dye acetate silks, as the action of the alkali at a high temperature first saponifies the silk and a simultaneous saponification and dyeing process goes on.

With the above facts clearly in mind, it will be easy to trace the evolution of the art of dyeing acetate silks. Perhaps the first method of dyeing Celanese was the natural outcome of the dyeing methods adopted for the other artificial silks. As has been explained, these are all practically reconverted into cellulose during the process of manufacture. For this reason it was thought that the simplest method of dyeing acetate silks would be to first saponify the fiber and so render it amenable to the ordinary dyeing methods with direct, sulphur and vat dyes.

Many patents were taken out along these lines, most of which covered some form of alkaline treatment. As an example, we might name British Patent No. 169,741, a method patented by the British Cellulose & Chemical Manufacturing Company in 1921, viz.:

"After cleaning the silk with soap and ammonia, it is saponified in a bath containing 100 gallons of water for every 10 pounds of dry Celanese silk and 30 per cent caustic soda (72 deg. Tw.) calculated on weight of dry silk. The bath is heated to 75 deg. Cent. and the silk entered at this temperature. After being worked well at this temperature for forty-five minutes, the silk is well washed in warm water, scoured in weak acetic acid solution, washed in soft water and lightly soaped."

The drawbacks of this process, however, soon became evident. Not only was there a serious loss in weight and a depreciation in the quality of the yarn, but in addition the production of level shades was almost impossible because of the difficulties attendant upon level hydrolysis.

Other methods were sought. For a while it was a common practice to dye acetate silk with those selected basic, acid and chrome dyes which had been shown to possess some affinity for this fiber. The cellutyl dyes (so-called) were such a selected range offered more or less as a stop-gap while the dyeing problems surrounding acetate silk were being solved in the research laboratory. For the reasons already cited, such dyeing methods and colors have been generally superseded, since colors synthesized purely for dyeing acetate silk are now available. There are, of course, exceptions to the rule, and basic, acid and chrome cellutyl colors are still used for the production of special effects.

Early observers had noticed that acetate silk, possibly because of its acidic nature, had a distinct affinity for organic bases, and it was apparent that the ingrain colors could be applied to this fiber by reversing the customary order of application. It is usual to dye cotton by padding with a naphthol and combining this with a solution of a diazotized amino body—Para Red being a familiar example. As acetate silk possesses no affinity for the naphthols, but has a strong affinity for the primary and diamino bases, this process can be reversed and amines, such as dianisidine, benzidine, para nitraniline, etc., can be dyed on Celanese silk, afterwards diazotized on the fiber and combined with naphthols, much as one dyes and develops Diamine Black BH or any developed color on cotton. It was found in practice that it was advisable to use as developers naphthols and not amino bodies, because of the affinity that the fiber itself has for amino bodies.

Such diazotizing and developing methods are still in use and still highly satisfactory for the production of full shades. There are, however, difficulties encountered in large-scale practice which make the process far from a satisfactory solution to the real problem of dyeing acetate silk in a comprehensive range of shades and styles. The affinity of the fiber for most bases is extremely powerful and more or less hard to control, giving rise to difficulties attending penetration and level dyeing which cannot always be easily overcome. The Azonines, Acedronoles, Silkons and Azaniles, names given to groups of developing dyes by various Continental manufacturers, are nothing but amino and diamino compounds which are capable of application to acetate silks in this manner. In the last eighteen months, however, the British chemist has gone far beyond this point.

Prolonged and intensive investigation of the dyeing properties of acetate silk has been conducted in England by research staffs of the British Cellulose &

Chemical Manufacturing Company and of the British Dyestuffs Corporation, who independently came to the conclusion that the problem of dyeing acetate silk could only truly be solved by the synthesis of specially designed coloring matters for the fiber. Prof. A. G. Green, the discoverer of Primuline, together with his assistant, K. H. Saunders, first tackled the problem for the British Dyestuff Corporation, producing a range of dyes known as Ionamines, which are now obtainable commercially for the dyeing of acetate silks. These can be described in Professor Green's own words:

"These dyestuffs consist of omega-sulphonic acids of amido-compounds. In these dyestuffs, which are easily soluble in water, the sulphonic group is situated externally to the nucleus, and when subjected to the action of weak alkalis or weak acids, the soluble compound is split up into an aldehyde bisulphite and an insoluble dyestuff base. These dyestuff bases, although nearly insoluble in water, are dissolved by the acetyl cellulose, for which they have a strong affinity. If, therefore, the Celanese silk is immersed in a hot bath of an Ionamine, rendered slightly acid or slightly alkaline, the above-mentioned decomposition slowly occurs and the insoluble dyestuff is absorbed and fixed upon the silk as it is produced, and the bath remaining clear throughout the dyeing operation. The actual coloring material, being produced within the fiber substance, penetrates throughout its mass, and being insoluble in water remains firmly attached. Provided suitable examples are selected for use the colors produced are very fast to washing and light. They vary in shade from yellow through orange and red to blue. Furthermore, since in many cases the coloring material thus produced on the fiber by decomposition of the Ionamines contains an amino group, it is capable of conversion into other colors by diazotization and development, in a similar manner to that of Primuline dyed upon cotton. By making use of different Ionamines and various developers a wide range of shades becomes possible. Thus, for example, by dyeing with Ionamine A and developing with beta-oxy-naphthoic acid, a beautiful fast black can be obtained.

"A valuable property of these new dyestuffs consists in their having no affinity for cotton, or for other varieties of artificial silk. Hence, if a mixed material of cotton and acetate silk, for example, a material in which there is a pattern in such silk upon a cotton ground, be dyed from a bath containing an Ionamine, only the silk will be colored, the cotton remaining white. Conversely, if such a mixed material be dyed from a bath containing a direct cotton dyestuff only the cotton will be dyed, the acetate silk being left white. Hence by using a bath containing both an Ionamine and a direct cotton dyestuff, it becomes possible in one operation to dye two colors, one upon the acetate silk and the other upon the cotton. Such a procedure has great advantages for the manufacturer, since the woven material can be stocked in the undyed state and dyed when required to any shade that may be ordered. When instead of two shades the same shade is required upon both fibers, this can be effected by a suitable choice of the Ionamines and of the direct cotton dyestuff. As viscose silk behaves like cotton in these respects, it is possible to produce very beautiful shot effects in one bath upon mixed materials of viscose and celanese silks."

The first Ionamines which were produced were all of the diazotizing and developing type. Of these four are now available, namely, Ionamine A, B, H, L. Ionamine A, which is used only for the production of a black by development with beta-oxy-naphthoic acid, should be dyed with the addition of a small percentage of soda ash, say 2 per cent. All the other Ionamines dye best when hydrolysis is effected in an acid bath, and 2 per cent of formic acid is generally recommended as a dyeing addition.

In order to fully diazotize the Ionamines and other amino bodies when applied to Celanese silk it is necessary to use nitrous acid solutions which are of far greater strength than is usual for the diazotization of developing colors on cotton. It is recommended that 5 per cent sodium nitrite and 15 per cent of 32 deg. Tw. hydrochloric acid be employed. Beta-oxy-naphthoic acid is a favorite developer and should be dissolved by boiling it with one-half its weight of soda ash, but it is important that, before developing, the bath be made slightly acid. This can be done by neutralizing with an equal weight of glacial acetic acid or its equivalent.

One striking difference between the development of Ionamines and the amino bodies generally on Celanese and the development of cotton colors is that with Celanese this operation is carried out at elevated temperatures. After diazotization the Celanese silk is entered cold into the developing bath and the temperature gradually raised to 50 to 60 deg. Cent., at which temperature it is kept for one-half hour, after which the goods are soaped and finished in the ordinary manner.

In addition to the four above-mentioned Ionamines which, with the exception of the B brand, are only recommended for the production of developed shades, there are at present available three direct dyeing Ionamines, namely, Ionamine MA, a direct yellow which can also be developed into orange and red shades, Ionamine Red GA which gives a yellow scarlet and is also suitable for development and Ionamine Red KA which is suitable only as a direct color. These direct dyeing Ionamines are simply dyed from a bath containing 2 per cent formic acid at a temperature not exceeding 75 to 80 deg. Cent. In fact, the maximum temperature at which Celanese should be

dyed—and in this it differs from Lustron—is 80 deg. Cent. Above this temperature the silk loses its luster or becomes "blinded" as it is called.

At approximately the same time that Professor Green was working out the Ionamines the British manufacturers of Celanese silk were also engaged in extensive research toward the same general end. Observation and trial had made it evident that those substances which were insoluble in water, or practically so, seem to possess the greatest dyeing affinity for this fiber. Professor Green, as has been shown, attacked the problem from a chemical standpoint. He, in producing the Ionamines, synthesized readily soluble products which during the dyeing operation were rendered gradually insoluble and in this form were absorbed by the fiber.

The British Celanese Company, Ltd., tackled the problem in a different manner. Instead of attempting to secure their end by purely chemical means, their research led into the realm of physical chemistry, with the final accomplishment of a series of colloidally dispersed dyestuffs which also represent a tremendous advance in the art of dyeing acetate silks. These colors are known as the S. R. A. Celanese dyes.

The S. R. A. colors offer a comprehensive range of dyestuffs, easy of application and of all-round good fastness. The method of preparation is comparatively simple, though a vast amount of work was necessary in order to weed out from the large range of insoluble compounds available such a selection as would afford a range of dyestuffs capable of dyeing Celanese under the same general conditions.

As a dispersing medium, highly sulphonated castor oil or sulphoricinoleic acid is used. It is found that many products and dyestuffs normally insoluble in water are readily soluble in highly sulphonated oils and that, further, when the solution of a dyestuff so prepared is poured into water a highly dispersed colloidal solution is obtained which is capable of dyeing cellulose acetate.

The S. R. A. colors are all sold in the prepared state. They are, generally speaking, a 10 per cent sulphonated ricinoleic acid dispersion of the dyestuff. The method of application is extremely simple—the necessary amount of color is simply mixed with the water, or soap solution, in the dye bath and dyed at temperatures ranging up to 75 to 80 deg. The whole of the present S. R. A. range, like the Ionamines, leave cotton and other artificial silks undyed. Wool is generally stained. The different products of the range vary considerably in their behavior toward silk.

In addition to the S. R. A. colors, there is also an analogous line of S. R. A. diazo solamines, which are amino bodies capable of subsequent diazotization and development—the insoluble amino bodies also being susceptible to colloidal dispersion through the medium of sulphoricinoleic acid.

The S. R. A. colors can be employed, as are the Ionamines, for the production of two-tone effects on cotton and Celanese, as they readily dye from the same bath with direct cotton dyestuffs. In this case, as with the Ionamines, the addition of the necessary salt to effect exhaustion of the direct cotton dye does not materially affect the dyeing of the S. R. A. color on the Celanese. It should be borne in mind, however, that where salt is used to excess there may be superficial fixation of the colors, with correspondingly inferior fastness, especially to rubbing.

More recent than the S. R. A. colors are two other classes known as "Celatene" and "Duranol" colors—the first being made by the Scottish Dyes, Ltd., the latter by the British Dyestuffs Corporation, and possessing many similar properties.

The Duranol colors are all prepared dispersions using a special medium, not of a sulphonated oil or soapy nature. These dispersions, even at dye bath strength, are of excellent stability and show no tendency to precipitate in practice.

There are four Duranol colors at present on the market—viz., Duranol Orange G, Duranol Red G, Duranol Red 2B and Duranol Blue G—though the number is shortly to be increased by other shades, notably a bright yellow and a violet. These Duranol colors are all derivatives of anthraquinone and possess the remarkable light fastness associated with vat dyes. They are sold in 10 per cent paste form and it is only necessary to dilute the color to dye bath strength, enter the acetate silk and dye at slowly rising temperatures up to about 75 deg. Cent. The bath exhausts almost perfectly in from one-half to three-quarters of an hour, and dyeings are produced of excellent fastness. The colors work well in combination and, as is the case with most of the later colors specially manufactured for acetate silk, they possess no considerable affinity for other fibers, particularly for those of vegetable origin.

Duranol Blue G from an acid bath dyes wool to almost the same shade as acetate silk, but the dyeing properties of the orange and reds are not materially affected by the addition of acid or alkali.

This method of dyeing by colloidal solubilization or dispersion opens up an interesting speculative field in the province of dye application.

It is well known that the production of fast colors on all fibers depends upon the fixation thereon of insoluble coloring matters. Many and varied are the methods of doing this—most of which involve several operations—the mordanting and dyeing of chrome col-

ors—the reduction to a soluble leuco base and the re-oxidation to the insoluble form in vat dyeing—the dyeing, diazotizing and developing of developed colors.

The new processes for the dyeing of Celanese, all of which are based on the simple absorption of insoluble coloring matters from warm watery dispersions, at least hold out the hope that the day is not far distant when the fastest colors can be applied to other fibers by equally simple methods.

[*This paper was concluded by a reading of Chapter VII, "The Goal," from "The Quest for Color," by D. A. T. de Mouilfried.*]

Discussion of "The Dyeing of Cellulose Acetate Silk"

O. H. Forsdale—What are the chemical differences between Lustron and Celanese?

Mr. Davies—Both are acetate silks but the manufacturers do not state their exact chemical constitution. They may be differentiated by their behavior toward basic dyes, Lustron silk having much more affinity and consequently dyeing heavier shades.

Wm. H. Cady—What Duranol colors are available and is there a direct black for Celanese?

Mr. Davies—At present there are available one orange, two reds, and a blue, with a bright greenish yellow and a violet to come shortly. A direct dyeing black of the Duranol type is also expected very soon.

George A. Moran—What are the fastness properties of the Duranol colors and how are they for level dyeing? Do they stain wool?

Mr. Davies—The Duranol colors are of excellent fastness to light, washing, alkalies, acids, perspiration and rubbing. They dye extremely level in combination and all of them slightly stain wool from neutral or alkaline baths. From an acid bath Duranol Blue G dyes wool quite readily, almost to the same shade as the Celanese.

Mr. Forsdale—What difficulties are experienced in drying? Is static electricity troublesome?

Mr. Davies—Dry heat does not affect Celanese any more than it does cotton or viscose. Prolonged action of moist heat will result in some diminution of luster. Celanese has remarkable insulating and di-electric properties and probably on this account static discharges should be guarded against.

H. Christison—Do the Duranol colors dye acetate silk fast to cross-dyeing and to fulling? Are the Duranol Scottish colors?

Mr. Davies—The Duranol colors have good fastness to the various cross-dyeing methods and an average fulling test. The Duranol colors are made by the British Dyestuffs Corporation, Ltd., the Scottish Dyes' colors of a similar type being known as Celatene colors.

Alan A. Claflin—How do these groups of dyes compare with Azonines of Cassella?

Mr. Davies—The Azonines of Cassella are not at all like the Duranol colors, but are simply primary and diamino bases.

Wm. R. Moorhouse—Are these dye bases sold in solution or in suspension?

Mr. Davies—The dye bases are sold in dispersion as diazo solamines, but are usually sold as the straight bases under various proprietary names. The water-soluble hydrochlorides can be used for dyeing, but in this case the best results are obtained where the suspension of the base is made in the dye bath by neutralizing the hydrochloride with the calculated amount of soda ash or other alkali.

Mr. Moran—Does Celanese silk lose its luster on saponifying?

Mr. Davies—It does to some extent, depending, of course, on the severity of the alkali treatment and the temperature employed.

Mr. Moorhouse—With what reaction should Celanese be left, acid, neutral or alkaline?

Mr. Davies—It has not come under my observation that Celanese decomposes if left slightly acid with organic acids. It is, of course, bad practice to allow any acid to be dried in a vegetable fiber. The manufacturers of Lustron recommend a neutralizing treatment of sodium bicarbonate in all cases where Lustron has been dyed from an acid bath. Celanese silk is usually lightly soaped after dyeing or else is dyed from a soap bath.

E. S. Chapin—In examining the dyeings you have passed around I notice that 5 per cent of color is required for a medium shade. What is the average cost of dyeing with Duranol colors?

Mr. Davies—The 5 per cent dyeings shown of Duranol colors were dyed with 5 per cent of the 10 per cent paste in which form the colors are marketed. They sell here, duty paid, at prices varying from $1.75 to $3 a pound. The colors are of the highest degree of fastness and do not come into competition with cheaper colors any more than Celanese comes into competition with cheap fibers.

Charles Spurr—Are the figures you name the cost for the 10 per cent paste?

Mr. Davies—Yes, just as vat colors are sold on the paste basis.

Mr. Chapin—What is the trade willing to pay?

Mr. Davies—That is something of which we have as yet had but little experience. Abroad, however, the trade is eager to pay proper prices for fast results.

Proceedings of the American Association of Textile Chemists and Colorists

ACTIVE ACIDITY AND ALKALINITY*

What Are They, and How Are They Measured?

By Dr. H. C. Chapin

It is common practice to determine the amount of acid in a solution by adding some indicator, such as phenolphthalein, litmus or Methyl Orange, and then titrating—that is, adding standard alkali solution until the indicator just changes color. This method fails in solutions so deeply colored as to obscure the tints of an indicator, but by electrical methods we can titrate as well as though indicator were present and its color visible.

By ordinary titration we measure only the total amount of acid, not its activity. Solutions of sulphuric and acetic acid respectively may prove equivalent in total acidity by neutralizing equal amounts of a standard alkali solution, but the sulphuric acid will be far more effective in driving an acid dye out of solution on to wool. We explain this by saying that a sulphuric acid solution possesses greater active acidity than an acetic acid solution of equivalent concentration; in other words, it has higher hydrogen ion concentration. What this is and how we measure it I shall now describe.

According to the theory of electrolytic dissociation or ionization, the sulphuric acid in a solution is dissociated to a large extent into ions. That is, hydrogen sulphate divides into hydrogen ions, each carrying a positive electrical charge, and sulphate ions carrying negative charges. In normal solution at ordinary temperature this takes place to the extent of approximately 50 per cent, with further dilution still more because in dilute solution there is more room for division.

$$\overset{50\%}{H_2SO_4} \longleftrightarrow \overset{50\%}{2H^+ + SO_4^{--}}$$

Acetic acid dissociates into hydrogen and acetate ions, but to a much smaller extent. In normal solution only about four-tenths of 1 per cent dissociates.

$$\overset{99.6\%}{H(COOCH_3)} \longleftrightarrow \overset{0.4\%}{H^+ + (COOCH_3)^-}$$

We can calculate the dissociation in a solution from the ability of the ions to carry electricity. It is easy to demonstrate that sulphuric acid dissociates more than acetic by fixing two electrodes at a convenient distance apart, connecting them through a lamp to the lighting circuit, and then dipping them first in normal acetic acid, later in normal sulphuric. Connected through the acetic acid, the lamp filament scarcely reddens, but with current through the sulphuric acid it glows brightly.

Nitric, hydrochloric and sulphuric acids are termed strong acids because of their high degree of dissociation. Acetic, formic, tartaric, oxalic and other organic acids are termed weak because little dissociated. We reserve these terms strong and weak for this distinction. Referring to the amount of acid in solution, we say concentrated or dilute.

In similar fashion we distinguish between strong bases, such as caustic soda or caustic potash, and weak bases, such as ammonia. In normal solution at ordinary temperatures potassium hydroxide is nearly 80 cent dissociated into potassium and hydroxyl ions, while ammonium hydroxide is but four-tenths of 1 per per cent dissociated into ammonium and hydroxyl.

Salts, of course, yield neither hydrogen nor hydroxyl ions, but most of them dissociate highly into their own ions, sodium chloride into sodium and chloride ions, ammonium acetate into ammonium and acetate ions, and so on. Curiously enough, the ammonium acetate is about as much dissociated as the sodium chloride, despite the weakness of ammonium hydroxide and acetic acid compared with the strength of sodium hydroxide and hydrochloric acid. If we connect our lamp through ammonium hydroxide it hardly lights. We pour in acetic acid, also a poor conductor, and the lamp brightens. Ammonium acetate formed in the mixture provides ions for conduction of the current.

From the formula HOH one might expect water to dissociate into hydrogen and hydroxyl ions. That this dissociation is exceedingly small is evident from the very low electrical conductivity of pure water. The hydrogen ions in a liter of absolutely pure water amount to but 1/10000000 of a chemical equivalent and the hydroxyl ions necessarily the same. We express this more simply as 10^{-7} for hydrogen ions and 10^{-7} for hydroxyl. The product of these two is then 10^{-14}. This apparently insignificant figure is of some importance to us, because it remains constant not only in water but in all water solutions. If, for example, the concentration and strength of the acid in a solution be such that there are 10^{-2} equivalents of hydrogen ions per liter, then the hydrogen and hydroxyl ions of the water in this solution so recombine as to leave but 10^{-12} equivalents of hydroxyl ions per liter, thus keeping the product constant at 10^{-14}. Or if the equivalents of hydroxyl ions in an alkali solution happen to be 10^{-3} per liter, then hydrogen ion concentration must be 10^{-11}. Knowing the hydrogen ion concentration of any solution, we can therefore calculate the hydroxyl

*A paper presented before the Northern New England Section of the American Association of Textile Chemists and Colorists, October 25, 1924.

ion concentration. Though interested in both hydrogen and hydroxyl ion concentrations—that is, active acidity and active alkalinity—we need measure only the hydrogen ions, and in terms of hydrogen ion concentration we can express the degree of either active acidity or active alkalinity. Still more convenient for ordinary use are the so-called pH numbers. We define the active acidity of a certain solution as hydrogen ion concentration 10^{-4} or pH 4, the neutrality of water as hydrogen ion concentration 10^{-7} or pH 7, the active alkalinity of another solution as hydrogen ion concentration 10^{-10} or pH 10, and so on. These pH numbers run all the way from fractions for high active acidity to nearly fourteen for high active alkalinity, increasing with alkalinity or decreasing with acidity. One can simply accept these pH numbers as shorthand descriptions of certain desired qualities in solutions, measure them and use them to get practical results without giving any attention to the underlying theory.

Between pH numbers and color change of indicators there is close relationship, important both in ordinary titration and in measurement of pH. Every indicator changes color at some definite pH, or over some definite range of pH numbers as in case of Methyl Orange. The change may occur approximately at neutrality, pH 7, as does that of rosolic acid or litmus. More frequently it comes at some degree of active acidity with pH below 7, as does that of Methyl Orange, or at active alkalinity with pH above 7, as does that of phenolphthalein. Below for comparison are a few approximate pH numbers for color change of indicators and active acidity or alkalinity of acid or alkali in normal solution:

Hydrochloric acid	pH 0.1
Acetic acid	2.4
Methyl orange	4.3
Ammonium chloride	5.0
Rosolic acid	6.4
Potassium acetate	9.0
Phenolphthalein	9.0
Ammonium hydroxide	11.6
Potassium hydroxide	13.9

At the beginning is hydrochloric acid, a strong acid nearly 80 per cent dissociated in normal solution into hydrogen and chloride ions. Its solution has a high hydrogen ion concentration and consequently low pH number. At the other end is caustic potash, also nearly 80 per cent dissociated. Its solution has high hydroxyl ion or low hydrogen ion concentration, therefore high pH. Mixing equivalent quantities of hydrochloric acid and potassium hydroxide we get potassium chloride and water. The potassium chloride yields neither hydrogen nor hydroxyl ions, so its solution is neutral, pH 7. Rosolic acid changes color at about this point, and therefore would serve to indicate practically exact neutralization of hydrochloric acid with potassium hydroxide. But as the pH remains fairly low so long as there is excess acid, then jumps to a fairly high number with the first drop of excess alkali, we can use any indicator in this range to mark the jump as we titrate strong acid against strong base.

With acetic acid and caustic potash it is quite different. Though we mix exactly equivalent quantities of the weak acid and strong base, we get not complete neutralization to potassium acetate and water but a certain balance, with some acid and an equivalent amount of base unchanged:

$$HCOOCH_3 + KOH \longleftrightarrow KCOOCH_3 + HOH$$

To this same point of balance reaction proceeds from the opposite direction when we dissolve potassium acetate alone in water. The acetate reacts with water or hydrolyzes until we have the same balance between weak acid and equivalent amount of strong base on the one hand and salt plus water on the other. At this point of balance the weak acid acetic yields few hydrogen ions and therefore has little effect on the pH of the solution, but the equivalent small amount of potassium hydroxide yields enough hydroxyl ions to raise the solution to an active alkalinity of about pH 9. To mark the point in titration at which we have exactly equivalent quantities of acetic acid and potassium hydroxide we need therefore not an indicator which changes at the pH of true neutrality, but one which changes at this actively alkaline balance point pH 9. Phenolphthalein changing at pH 9 serves this purpose.

In titration of the strong acid hydrochloric against the weak base ammonium hydroxide the balance point comes on the acid side at approximately pH 5. Of the indicators represented here, Methyl Orange obviously is best for this titration.

It is clear, then, that in titration of weak acid or base by indicator it is necessary to choose an indicator changing at approximately the right pH. Using electrical methods, we measure pH from time to time as we add acid or alkali in titration, and stop at whatever pH we desire. Both indicators and electrical methods serve two purposes, first, to mark end points in titration for determination of total acidity or alkalinity and, second, to determine pH which is a measure of active acidity or alkalinity.

For titration we prefer an indicator with sharp color change like phenolphthalein, provided that we can find

one changing at the right point. But for measuring pH we prefer one like Methyl Orange, which passes through a number of tints, each at some distinct pH, because with such we can make measurements over a considerable range instead of at the one point indicated by a sharp change. We can make or purchase a set of tubes showing the tints of such an indicator at intervals of two-tenths of a pH unit over the useful range of the indicator. Adding a measured quantity of the same indicator to a solution under investigation, we determine its pH by comparison of its tint with those of the standards, assuming its pH to be that of the standard to which it comes nearest in color. With slight modification this method may be applied to a solution containing a trace of turbidity. It is simple, rapid, and, applied to suitable solutions, is accurate enough for many technical purposes. It is used regularly in controlling purification of water supplies, in soil analysis, flour examination and many other routine operations of test or control, as well as in research.

For solutions which are already colored or very turbid, indicators are useless, and we must turn to electrical methods for either titration or pH measurement. These require more apparatus and a little more skill in its operation, but not too much for ordinary test or process control outside the laboratory. In the hands of a trained chemist they are capable of high accuracy. They serve as standards for checking the indicator methods.

The electrical apparatus consists of a cell of which the solution under observation forms a part, together with some device for measuring the voltage generated. We can understand its operation more clearly by analogy with a simple Daniell cell, consisting of zinc dipping in zinc sulphate solution contained in a porous earthernware cup, this cup in turn dipping in a copper sulphate solution which holds also a copper electrode. Current flows from the zinc through the zinc sulphate solution, out through the pores of the cup, through copper sulphate solution to copper, thence through wire, etc., back to the zinc. Zinc dissolves and more copper plates out upon the copper electrode. Let us consider the source of electrical pressure or voltage driving this current. Assuming zinc sulphate to be split into zinc and sulphate ions and copper sulphate into copper and sulphate, we find four sources of energy, two in one direction and two opposed. These are the tendency of zinc to go into solution carrying current forward and the tendency of zinc ions to plate out upon the zinc electrode carrying it back; on the other side the tendency of copper ions to plate out carrying current forward, opposed by copper metal trying to go into solution and carry it back. The net result is that zinc dissolves and copper plates out. Impressing from an outside source just enough measured voltage to prevent this action, we get a measure of the voltage of the cell. This voltage could be used to determine the concentration of zinc ions in a solution in the following manner. Suppose that we fix the concentration of the copper sulphate. Then three of the four factors influencing the voltage of the cell are fixed, and the voltage, varying with the zinc ion concentration alone, serves for calculation of zinc ion concentration.

Now substitute for zinc electrode in zinc sulphate, hydrogen electrode in hydrogen sulphate or other solution containing hydrogen ions; and for copper sulphate solution of fixed concentration with copper electrode, a saturated solution of mercurous chloride with mercury electrode. To guard the solutions against mixing, put them with their respective electrodes in separate vessels and connect them by a bridge consisting of a tube filled with potassium chloride solution of definite concentration. Measuring the voltage of this cell, we have then means of calculating the hydrogen ion concentration in the first solution. This calculation is simplified by use of tables or a special slide rule. Hydrogen, being a gas, does not form a convenient electrode by itself. It is necessary to dissolve it in the surface of a piece of platinum, which we make more adsorbent by a coating of very finely divided platinum. To maintain constant concentration of hydrogen in this surface, we keep it in constant or intermittent contact with hydrogen gas at approximately constant pressure, as well as in contact with the solution under investigation. For measuring the voltage a potentiometer is the standard instrument, though a voltmeter is more convenient and often good enough.

Discussion of "Active Acidity and Alkalinity"

Winthrop C. Durfee mentioned the use of electrical apparatus by Cheney Bros. Silk Company in controlling the pH of dye baths.

Alan A. Claflin called attention to the use of similar apparatus in the leather industry, especially to control non-tannin acidity in tanning sole leather, where a definite pH is desired to control plumping. He stated that the apparatus was used by unskilled labor. He believed that it would find more extensive use in the textile industry. He spoke of the effect of dilution of acids upon the pH of their solutions, saying that while the dilution changed the pH of the solution of a strong acid it made little difference in the pH of a weak one, 5 per cent acetic acid solution having about the same pH as 15 per cent.

John F. Bannan mentioned a universal indicator showing changes in spectra corresponding with a wide range

of changes in the pH. He emphasized the importance of the determination of the pH number by the indicator method in controlling water purification for mills.

Hugh Christison asked what pH was best for coagulating aluminum hydroxide formed from alum in water purification; also, what effect ammonium acetate would have on electrical determination of the pH.

Dr. Chapin answered that reports from filter plants indicate a maximum precipitation of aluminum hydroxide with effluent between pH6 and pH7, that is, with slight active acidity. Very good results have been obtained at 6 to 6.3. Ammonium acetate added to the solution of a strong acid would actually lower the pH. It probably would not interfere with accurate electrical measurement of the pH. So-called "salt effects" sometimes cause inaccuracy with indicators but less frequently with electrical measurement.

Wm. D. Livermore asked if the electrical method depended upon conductivity, and whether it could be used to measure the active acidity of a used sulphuric acid or aluminum chloride carbonizing liquor.

Dr. Chapin answered that the determination of the pH by ordinary electrical methods depends not on conductivity but rather on measurement of the voltage of a cell containing the solution under investigation. We balance this against a known voltage much as we balance water pressure against a mercury column. At the moment of balance there is no current flowing. It is probable that the method could be applied to both carbonizing liquors.

Harry R. Davies asked if what Mr. Livermore wanted to know regarding carbonizing liquors was not concentration rather than pH.

Dr. Chapin answered that both acid concentration and acid activity, that is pH, can be measured by the same electrical apparatus. In the aluminum chloride liquor pH is unquestionably the more important factor. We want to know the balance between aluminum chloride and hydrochloric acid in the solution. pH is a measure of this balance. Titration for total acid destroys the balance and actually liberates through hydrolysis more acid than is present at the point of balance.

E. S. Chapin asked the cost of the electrical apparatus and the time necessary to make a measurement with it.

Dr. Chapin answered that the apparatus costs from approximately $100 upward according to the accuracy desired. With everything ready it takes less than a minute to make a pH measurement. Titration involves a series of such measurements and, of course, takes a little longer than a series of mere observations of the color of an indicator. Extra time and labor involved in the electrical method are consumed mainly in setting up the apparatus and preparing hydrogen electrodes, which, once ready, serve for many determinations.

O. H. Forsdale inquired whether the apparatus could be used to measure the free alkali in sodium hypochlorite solution or the concentration of sodium sulphide in a dye bath, and asked an explanation of the term "buffer solution."

Dr. Chapin answered that strongly oxidizing solutions prevent proper saturation of the electrode with the hydrogen, so that we probably could not use the method successfully on hypochlorite. Sulphites sometimes interfere. By the ordinary method we could at best determine only the alkalinity, not sodium or sulphur. A buffer is something which behaves like potassium acetate in giving to a solution some definite pH and resisting change in this pH by other reagents. In this way phosphates preserve constant pH in the human blood.

Walter C. Durfee asked if the pH of soap solutions could be measured electrically.

Dr. Chapin answered that McBain and his associates have published results of such measurements.

. . . The meeting adjourned at 9.30 o'clock after giving a rising vote of thanks to the speakers of the evening for their valuable papers.. . .

OCTOBER MEETING OF THE PHILADELPHIA SECTION

The regular October meeting of the Philadelphia Section of the American Association of Textile Chemists and Colorists was held Friday, October 10, 1924. At 6.30 p. m. fourteen members and guests sat down to the regular informal dinner at the City Club of Philadelphia.

The meeting was called to order at 8.30 p. m. in the auditorium of the Philadelphia Textile School by the Chairman, Dr. Chas. S. Hollander.

The minutes of the previous meeting were read and approved as read.

Dr. Hollander then reported to the Section briefly concerning the progress that was being made by the various committees in charge of the arrangements for the annual meeting of the Association to be held in Philadelphia on December 6th at the Bellevue Stratford Hotel.

There being no further business Dr. Hollander then introduced the speaker of the evening, J. Knup, of the Hellwig Silk Dyeing Company, who gave a most interesting and instructive talk on the subject: "The Weighting and Dyeing of Skein Silk." An abstract of the same is published herewith.

On motion of Mr. Bertolet a rising vote of thanks was tendered the speaker.

The meeting adjourned at 10.15 p. m.

There were seventy present.

PERCIVAL THEEL, Secretary.

Come to Philadelphia December 6, 1924

Proceedings of the American Association of Textile Chemists and Colorists

THE WEIGHTING AND DYEING OF SILK*

Abstract by Charles E. Mullin from notes by William Sterisker

A discussion of the physical properties of silk and its resistance to acids was followed by a short description of the variations in silk grown in different localities.

The outer layer of raw silk, the sericin, is soluble in hot soap solution, alkalis, etc., and one of the variations in different silks is the solubility of this sericin; that of Japanese silk being much more soluble and therefore easier to remove than that from China or Italian silks.

Some of the apparent dyeing faults are caused by poor reeling, which may cause apparent uneven dyeing, but the real fault is unevenness in the thread, caused by breakage, due to poor reeling. As received in America the skeins must be soaked to unwind. This soaking is done in a solution of olive soap. Other soaps and alkalis are sometimes used, but olive foots soap is probably the most satisfactory. The use of alkalies in the soaking bath increases the speed of softening and gives a softer silk but may cause a serious damage to the silk fiber. After rewinding, the silk is not washed or rinsed, and as the silk may be stored for some time in the rewound form, any moisture present may cause a concentration of alkali in certain portions of the skein which destroys both the luster and strength of the fiber.

In Chinese and Italian silks, which are more or less sticky in winding off, if the gum is not thoroughly softened in rewinding, trouble may be experienced in twisting, due to the gum sticking slightly in some parts of the skein, causing uneven tension in the thread produced, which is in turn a cause of low tensile strength in the thread. Poor reeling may cause uneven penetration by the dye and consequently unlevel shades.

The reeled silk is usually boiled off in a solution of neutral soap. Here again olive foots soap is used, but olein soap is very good and may be used. The gum first becomes slimy, then gelatinous and finally loosens from the fiber. When the gum is in the gelatinous condition, the silk is very slippery and hard to handle and this often causes trouble when it is boiled off in the tubs on dyesticks. The foam method of boiling is much more satisfactory and is usually completed in about forty minutes. While many substitutes for soap have been tried in the boil-off bath, nothing has been able to replace it. The fermentation process gives good results but requires too much time. The loss in boiling-off is usually about 25 per cent of the weight, and after washing the silk is ready for dyeing. However, it is usually dried first and then weighted before dyeing.

Some silks for special purposes, such as for ribbons, are not boiled off, but are given an acid treatment to harden the gum. These are known as "souples."

In weighting silks for colors, the tin method of weighting is almost universally used, but for blacks, tannin containing materials, such as sumac, is used. The silk may be hung on dyesticks in a bath of tin tetrachloride and later hydroextracted, or it may be placed in a rubber-lined hydroextractor and the 28 deg. Be. solution of the chloride run through it. The excess of tin solution is then washed out of the silk and it is treated in the same manner for about one hour with a sodium phosphate solution, after which it is again washed. It has now gained about 15 per cent in weight, and the tin treatment followed by the phosphate may be repeated as often as desired, after which the fiber is treated with a 5 deg. Be. solution of sodium silicate at 140 deg. Fahr. The silicate adds weight according to the amount of tin present, two-pass silk gaining about 12 to 13 per cent, three-pass 20 per cent and four-pass silk takes up about 30 per cent of silicate, giving the silk a decided luster. It is washed in warm water and then in hot soap solution.

If the weighted silk weighs the same as the silk weighed in the gum, it is said to be 16-ounce weighting. In other words, the weighting takes the place of the 25 per cent of gum removed. Twenty-four-ounce weighting means that the weight of the degummed silk has been doubled.

There have been many theories advanced to cover tin weighting. Cotton and wool take up only 0.5 to 2.0 per cent of weighting under similar conditions. It was formerly thought that the tin solution was absorbed and then hydrolyzed to $Sn(OH)4$ in the fiber on washing, but as the tin is fixed from an anhydrous benzene solution, this theory did not cover the process. Silk takes up much less iron and chromium than it does tin, and it has been proven that tin tetrachloride will react with the amino acids present in silk. The following may represent the reaction: $SnCl_4(silk)_4 \rightarrow$ on washing: $SnCl_3(OH)(silk)_3 \rightarrow$ on further washing $Sn(OH)4$ + silk. Such a reaction would explain why the silk will take up more tin on each pass through the tetrachloride bath.

In the sodium phosphate bath the tin reacts to form tin phosphate, which is ordinarily a white powder but in this instance is transparent, due to some unexplained reason, probably connected with colloid phenomena. The reaction is possibly:

$$Sn(OH)_4 + Na_2HPO4 = Sn(ONa)_2HPO4 + 2H_2O,$$

and in washing:

$$Sn(ONa)_2HPO4 + 2H_2O = Sn(OH)_2HPO4 + 2NaOH.$$

Silicate is possibly taken up by colloidal absorption.

*Abstract of an address by J. Knup, of the Hellwig Silk Dyeing Company, before the Philadelphia Section of the American Association of Textile Chemists and Colorists, October 10, 1924.

There is considerable room for research along these lines as the process does not always follow through smoothly. Sometimes the wrong weighting is obtained, or the silk may lose luster or become harsh for some unknown reason. Tin weighting always causes some loss in strength, but this is comparatively slight in weightings up to 18 ounces, and not dangerous in weightings below 26 ounces; however, much silk is even weighted to 32 ounces and looks and feels better than the unweighted silk.

Phosphate builds up in the tin liquor and tin accumulates in the phosphate bath, which in time causes trouble if not removed. The use of anhydrous tin tetrachloride has greatly aided in economical weighting as with it the tin bath can be strengthened without much increase in volume.

Weighting improves the luster, volume and appearance of silk. It reduces the price and does not seriously decrease the strength unless carried too far. Silk is the strongest fiber we have and in many cases the styles change so rapidly that the material is never worn out anyhow; however, this is not the case with silk for gloves or cloth, which should not be weighted, and there are many other exceptions.

In weighting for black, the silk is treated with the tin tetrachloride and phosphate in the same manner as for colors. It is then treated with a solution containing tannin. Two passes give a 24-ounce silk, while with the silicate treatment only a 16-ounce weighting is obtained. The tannin weighting does not weaken the silk materially up to about a 32-ounce weighting. Logwood and many other dyes are absorbed directly by the tin-tannin weighted silk.

In dyeing by means of the silk gum bath, the gum no doubt absorbs the dye first, and as the bath is acidified in the presence of the silk, the gum gradually gives up the dye to the silk fiber.

TWENTY-FOURTH RESEARCH COMMITTEE MEETING

The twenty-fourth meeting of the Research Committee of the American Association of Textile Chemists and Colorists was held at the Engineers' Club, Boston, Mass., on Friday afternoon, October 17, 1924.

The following members were in attendance: L. A. Olney, W. D. Livermore, W. H. Cady, W. C. Durfee, G. A. Moran, W. K. Robbins, W. M. Scott, R. F. Culver, J. F. Bannan, E. H. Killheffer, R. F. Culver, R. E. Rose, H. W. Leitch and W. E. Hadley.

H. W. Leitch read a paper outlining the work which it is considered desirable to attempt, relative to the fastness of dyed materials to the action of acids, carbonizing, cross-dyeing, acid milling, urine, etc., which is to be the work of a special committee comprising William R. Moorhouse and H. W. Leitch.

In view of the work already accomplished in regard to the action of various forms of artificial fading devices and their relation to the sunlight, it was felt that it would be of decided interest to publish a list of those dyes which apparently act similarly under both conditions, as well as a list of those which act differently. Such a list could be extended from time to time and should prove of very definite value. The list, upon which information is at present available, is being prepared and will shortly be published.

Dr. W. M. Scott reviewed a supplementary report on fastness tests upon silk dyes, which report was published in the October 20 issue of the Proceedings.

Attention was drawn to the fact that while the tentative Fastness Tests published in the Year Book used certain dyes as standards for comparison of the fastness values of the coloring upon the fabrics, it should be easily possible by transposition to classify the different dyestuffs in relation to the fastness which they exhibit upon textile fabrics.

W. E. Hadley, Secretary

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Sivan, F. W., 650 East 219th Street, Bronx, N. Y.

Williams, Charles, 28 Summer Street, Adams, Mass.

ASSOCIATION BADGES

Those who attended the Annual Meeting at Providence had an opportunity to examine and purchase the new lapel button badges which were there distributed by the Secretary.

For the benefit of members who were unable to attend the meeting an illustration of the badge is shown herewith.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

WALTER E. HADLEY,
5 Mountain Avenue,
Maplewood, N. J.

Come to Philadelphia December 6, 1924

THE Annual Meeting of the American Association of Textile Chemists and Colorists will be held in Philadelphia, with headquarters at the Bellevue Stratford Hotel, on Saturday, Dec. 6th, 1924

A number of unusually good papers will be presented during the Saturday morning and afternoon sessions and there will be several speakers of national reputation at the banquet in the evening.

A pleasant surprise will be in store for those who can arrange to arrive in time for the "Get-Together Smoker" on Friday evening, December 5th, which will also be held in the Bellevue Stratford Hotel.

Those in attendance will feel amply repaid. Philadelphia is a textile centre of unusual interest and importance. A few prominent local manufacturers have consented to show samples of particular merit. Don't miss this chance of seeing something of Philadelphia's great Textile Industry.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

LOUIS A. OLNEY
PROFESSOR OF CHEMISTRY AND DYEING, LOWELL TEXTILE SCHOOL
Directing Editor

CLAYTON HOAGLAND
Managing Editor

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THE BLINDNESS OF JUSTICE

BACK in February, 1919, the Alien Property Custodian sold to the Secretary of the Navy, representing the United States, all right, title and interest in and to 129 German radio patents seized during the war. Two weeks ago, on October 30, the Navy Department decided to issue licenses to sixty independent American radio manufacturers under these former German patents. In a recent account of this transaction it is stated:

"There is no question about the legality of sales of this nature. Title to property so acquired vests in the United States. The Attorney-General has so decided. . . . It is claimed that this grant of license by the Navy Department to the independent radio manufacturers will completely change the complexion of patent litigation."

Why does the Government persist in its suit to recover the German dye and chemical patents sold to the Chemical Foundation? In this stubborn, inconsistent attitude it has taken the Government is like a big schoolboy who has sold two sticks of candy and is now crying lustily to get one of them back. It has permitted a confounding swarm of legal technicalities to blind it to the essential facts in regard to the sale of these dye patents. It has assumed an entirely false perspective in its view of the sale and its validity.

It is time that someone of intelligence, with a keen perception of essentials, and, necessarily, possessed of sufficient authority, sweep aside all questions of Mr. Garvan's double capacity and Mr. Polk's doubtful authority and President Wilson's judgment, all flimsy charges of inadequacy of price and of license fees, all libelous attacks aimed at the Chemical Foundation and its purpose and at the honor of the leading men involved, all threadbare allegations of conspiracy and of violation of the criminal code and the principles of law and equity, all hollow-sounding assertions of illegality, and leave standing alone, in the light, this great fundamental truth—the sale and proper licensing of these dye and chemical patents was of inestimable importance to the future welfare of this country, and those far-sighted men whose rare judgment and conscientious, unremunerative toil evolved from that sale results of great formative power in the fostering of one of our vital industries, should be proclaimed as the safeguarders of our national defense and the benefactors of the nation at large.

THE ELECTION AND BUSINESS

THE election of Calvin Coolidge and of a working majority in both houses of Congress demonstrated the deep faith of the American people in Mr. Coolidge personally and in the conservative policies which he has consistently advocated.

Nothing is more productive of financial prosperity, and of good-will and harmony and the other virtues so desired within an industrial organization, than liberal common sense and a perfect co-operation among its executives and employees. So it is with the national government, in which we as citizens represent the workers. The selection of the men to control our government should be invariably guided by these fundamental principles of common sense and co-operation. As the next four years pass we shall probably be well assured that our selection this time has been wise. Let us congratulate each other. Let us congratulate ourselves as the voting population that by our selection this government has been made impregnable for at least four years to the pernicious influences of radicalism.

The future course of radicalism cannot be foretold. But if history repeats itself it will be a rueful day for the independents when they again set up their soap boxes and endeavor to disrupt the structure of the government bestowed upon posterity by Washington, Hamilton and men of their character. Before election sinister stories of the prodigious strength of the new party awed the gaping citizen until he was persuaded that radicalism, with its horde of red ties and touseled hair, had come to stay and to take a controlling part in our government. But the result at the polls revealed that this scarecrow was, like all scarecrows, stuffed with straw and inflated with wind.

The voting majority ignored the ballyhooing demagogues with their patent panaceas for this poor, sick, downtrodden land of ours, and have by their good judgment and trained business sense created a foundation for a period of business prosperity that is even now manifesting itself. What the radical delights in defaming as "big business" should, by all economic laws, grow still bigger under an administration chosen by the people for its hard-headed common sense and its intelligent co-operation with the industrial interests of the nation.

Dyestuff Tables

A List of the Principal American-Made Colors with Their Properties and Fastness Characteristics

[NOTE: The publishers of The REPORTER have secured more or less complete data in regard to many of the dyestuffs which are at the present time being manufactured in the United States. As the following material has been brought together from various sources, they realize that errors are quite likely to appear, and it is earnestly requested that any readers who find errors or who are able to give additional information will communicate with the publishers in order that this material may be made as correct, complete and up to date as possible. These tables will appear serially until all colors upon which we have data shall have been covered. The publication of this data was begun in the issue of March 10, 1924.]

CLOTH RED G
(Schultz No. 234)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Chrome mordant or from a slightly acid or neutral bath. On a heavy mordant the shades are faster to milling.

SHADE: Dark full shade of red.

SOLUBILITY: Not very good with hard water; use 1 per cent tannic acid.

LEVEL: Does not dye level; sensitive to acid and hard water.

FASTNESS TO:

Acid: Fast to organic acids.
Alkali: Fast.
Carbonizing: Fast.
Cross-Dyeing: Will not stand cross-dyeing.
Fulling: Stains white wool and white cotton; shade goes bluer.
Light: Fast.
Rubbing: Crocks slightly.
Scouring: Fast.
Steaming: Will not stand steaming.
Sulphur: Fast.
Washing: Excellent.
Water: Fast.

SENSITIVE TO METALS, LIME: Sensitive to hard water.

DYED BY OTHER METHODS: Can be dyed chromate, but shade is weak and not fast to fulling; shade goes bluer. Dyes wool in neutral bath.

ON UNIONS: Cotton-wool unions dyed acid: The cotton is slightly stained. Wool-silk unions: The silk is lighter than the wool.

COMPETING PRODUCTS: Made in the United States by Cincinnati Chemical Works; New England Aniline Works (Selling Agents, U. S. Color & Chemical Company); American Aniline Products, Inc.; Newport Chemical Works; Dye Products & Chemical Company; Garfield Aniline Works; Palatine Aniline & Chemical Corporation (Selling Agents, F. E. Atteaux & Co.).

AZO ACID VIOLET
(Schultz No. 229)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Acid.

SHADE: Reddish violet.

SHADE BY GASLIGHT: Redder.

SOLUBILITY: Good.

LEVEL: Same as S-147.

FASTNESS TO:

Acid: Fast.
Alkali: Moderate shade; goes lighter and redder.
Light: Moderate; inferior to Victoria Fast Violet 2R.
Potting: Bleeds.
Rubbing: Fast.
Scouring: Scours off.
Steaming: Fast.
Sulphur: Fast; shade turns slightly redder.
Washing: Fast with neutral soap.

OTHER PROPERTIES: Suitable for ladies' dress goods.

DISCHARGING: Discharges white with zinc.

COMPETING PRODUCTS: Made in the United States by Dye Products & Chemical Company, under name of Azo Acid Violet, and Chemical Company of America, under name of Azo Acid Violet B.

NEUTRAL GRAY G
(Schultz No. 241)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Cotton and silk.

USUAL METHOD OF DYEING: On cotton direct from a bath of common salt or with soda ash and soap.

SHADE: Bluish gray.

SOLUBILITY: Good.

LEVEL: Dyes level.

FASTNESS TO:

Acid: Fast against mineral and organic acids.
Alkali: Excellent.
Chlorine: Color is destroyed.
Light: Relatively fast; excels the Benzidine colors.
Rubbing: Fast.
Steaming: Fast.
Sulphur: Will not stand stoving.
Washing: Bleeds on washing.

ON OTHER MATERIALS: Suitable for silk and cotton silk unions.

COMPETING PRODUCTS: Made in the United States by Newport Chemical Works; Calco Chemical Company; Garfield Aniline Works.

CLOTH SCARLET G
(Schultz No. 246)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Acid, top chrome or chrome mordant. The heavier the chrome the faster the shade to milling. The shade is brightest on a heavily reduced chrome mordant.

SHADE: Bright full scarlet of excellent covering power.

SOLUBILITY: Good.

LEVEL: Dyes level in a weakly acid bath.

EXHAUSTS: Does not exhaust clear.

FASTNESS TO:
Acid: Fast on a chrome mordant.
Alkali: Fast on a chrome mordant.
Fulling: White cotton and white wool are stained.
Light: Fast enough for ladies' dress goods.
Potting: Bleeds slightly.
Scouring: Bleeds off and stains whites.
Sulphur: Goes yellower on stoving.
Washing: Fast on a chrome mordant.

DYED BY OTHER METHODS: Top-chromed, the shade is darker and somewhat duller. Dyes the wool well in a neutral bath.

ON UNIONS: On Gloria the silk is lighter than the wool. Cotton-wool unions: Dyed acid the cotton is nearly white.

COMPETING PRODUCTS: Made in the United States by Dye Products & Chemical Company; Calco Chemical Company.

SCARLET EC
(Schultz No. 247)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Glauber salt and sulphuric acid.

SHADE: Bright scarlet with a bluish cast.

SHADE BY GASLIGHT: No change in shade.

SOLUBILITY: Good.

LEVEL: Dyes level only with extreme care.

EXHAUSTS: Well.

FASTNESS TO:
Acid: Fast.
Carbonizing: Fast.
Cross-Dyeing: Will not stand cross-dyeing.
Fulling: Stains white cotton badly; white wool stained slightly. Top-chromed, stains the cotton somewhat less.
Light: Stands fourteen days' exposure.
Potting: Will not stand potting.
Rubbing: Color crocks slightly.
Scouring: Bleeds off and stains whites.
Steaming: Fast.
Sulphur: Bleeds slightly after stoving.
Washing: Color bleeds.
Water: Color will not stand Markischer test.

SENSITIVE TO METALS, LIME: Sensitive to hard water.

DYED BY OTHER METHODS: Top-chromed, the shade is a little darker.

ON UNIONS: Silk-effect threads are stained heavily. Cotton-effect threads are stained nearly as heavy as the wool.

ON OTHER MATERIALS: The color dyes Gloria from a neutral bath a bluish red. Paper: Suitable.

COMPETING PRODUCTS: Made in the United States by American Aniline Products, Inc.; Dye Products & Chemical Company; National Aniline & Chemical Company; New England Aniline Company (Selling Agents, U. S. Color & Chemical Company); Newport Chemical Works.

MILLING ORANGE
(Schultz No. 250)

COMPOSITION: Disazo.

SPECIALLY SUITABLE FOR: Wool.

USUAL METHOD OF DYEING: Chrome mordant, top chrome or chromate.

SHADE: Orange.

SOLUBILITY: 15 gr. per liter.

LEVEL: Dyes level.

EXHAUSTS: Well.

FASTNESS TO:
Acid: Fast.
Alkali: Fast.
Carbonizing: Fast.
Fulling: Fast; does not stain white when top-chromed.
Light: Superior to S-177.
Potting: Inferior to a mixture of S-177 and S-400.
Rubbing: Fast.
Sulphur: Very moderate.
Washing: Fast.

SENSITIVE TO METALS, LIME: Very sensitive to iron.

OTHER PROPERTIES: Shade can be matched with three parts S-177 and one part S-400. This mixture is faster to steaming and potting, but not as fast to light.

ON UNIONS: Leaves cotton and silk effect threads pure white.

COMPETING PRODUCTS: Made in the United States by Newport Chemical Works, under name of Fast Chrome Orange G; New England Aniline Works (Selling Agents, U. S. Color & Chemical Company), under name of Acid Anth Orange GR and Anthranol Chrome Orange GR.

DYE APPLICATION IN CHINA

(*Continued from page 742*)

retail selling of piece goods, dyes, or sundries, in which the shop is interested. There will be a small reception or lounging space or room where more favored visitors engaged in buying or selling may sit, drink tea, and transact business. Directly behind this first building is an open courtyard varying in size from a hundred to several thousand square feet. Around this courtyard are other buildings or sheds in which the workmen live and carry on their trade.

Water for dyeing may be obtained from a near-by stream or canal, or from a well sunk in the courtyard.

There are usually racks made of poles, extending into the air some twenty feet, on which the dyed material is hung to dry. These may take up all the open space in the court. During the summer, in dyehouses applying vegetable or direct colors not fast to light, the racks and even the whole courtyard itself will be covered with matting.

The dyeing apparatus is simple and crude. Where heat must be applied in the dyeing process the vats are built up over a fireplace. The basis of each vat is a shallow cast-iron dish (see Fig. 1) varying in diameter at the edge from two to four feet. The fireplace, of brick, is partly sunk in the ground, the iron dish placed in position above it, and the walls of the vessel carried to two or three times their original height with more brick work or wooden staves. The whole is covered inside and out with cement, making a smooth, waterproof surface. Gases from the fire are led away by a small brick chimney which extends to the level of the surrounding roofs.

Such vats as these are placed in one-story buildings or sheds opening into the central courtyard. Each dyehouse will have at least one and sometimes a dozen of them. Their capacity varies from twenty-five to a hundred or more gallons.

They are cheap to build, appear to have a long life and give sufficiently satisfactory results to suit the demands of the country.

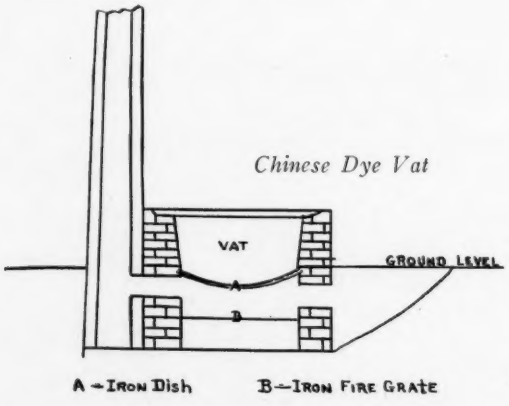

FIG. 1

Fuel varies with the locality. Straw, leaves, small reeds and bushes, very occasionally cord wood and sometimes coal are used. The writer has seen an aged coolie seated at the opening to a fireplace under a 100-gallon vat kept boiling all day long for the dyeing of Direct Black on silk yarn, feeding the flames with nothing but rice straw. On other occasions one man has been observed to handle batch after batch of Sulphur Black on cotton yarn and do all the work himself, including keeping the vat at a boil with a very fine grade of anthracite coal.

For cold dyeing, mordanting, washing and rinsing, earthernware pots or "kongs" are used. Mention has been made of such in a previous article where they were termed "soochow pots." These are flat-bottom affairs about two feet high by three feet diameter at the top and have a slight taper toward the bottom. They can be moved about as occasion demands.

Besides the above there are a few stout posts fixed in the ground, with cross pieces near the top (about four feet above the ground), on which wet material may be twisted for extraction.

No other appliances than those already described are necessary for the Chinese dyer to turn out some surprisingly good results.

Application of Vegetable Black—Removal of Sizing

Now let us return to the operations in the production of Vegetable Black on cotton-piece goods. The material is prepared for dyeing usually by giving it a short boil, either in water alone or containing a little alkali. Caustic soda and soda ash, especially the latter, are well known throughout China, due to the enterprise of a large British manufacturer, and are more and more being used by native dyers. The pieces are not sewed or otherwise fastened together. Each piece, folded as it comes from the weaving mill, is placed on the side of a vat and poked into the liquor by catching the top fold on the point of a stick. A sufficient number of pieces are added to half fill the vat if packed tightly. The vat is boiled for twenty minutes or half an hour, the cloth lifted out and piled on the edge of the vat or on a lattice laid over it to drain for a few minutes, and then beaten on a flat stone or plank for a while to aid in the loosening of the sizing and natural impurities. After a few rinsings in a "kong," followed by squeezing on posts it is ready for dyeing.

Mordanting and Dyeing

A sufficient quantity of iron mordant liquor from the stock vat is placed in a "kong," the "boiled off" material put in, and the whole stirred about by hand. There is usually one workman to each kong. To insure penetration and evenness he will find one end of a piece of cloth and draw it through the liquor, at the same time opening it out, until the whole piece has passed through his hands.

Time of immersion varies with the material, the thoroughness with which it has been cleaned in the "boil off," and the care and skill of the workman. Sometimes a few hours are sufficient, during which time the goods may have been opened out three or four times. Some shops steep overnight.

After extracting the mordanted goods by twisting they are put into a dye vat, constructed as described previously, containing a sufficient quantity of the Vegetable Black extract. The bath is raised from cold to a boil as soon as possible and boiled half an hour. The goods are worked about during the period of dyeing either by hand or with poles.

Some dyehouses give a second mordanting after the dyeing. Sometimes the full shade of black is built up in several mordanting and dyeing processes. In certain sections of the country it is customary to bottom or top the black with indigo—custom demanding that the finished material fade blue.

After rinsing and squeezing the dyed material it is hung on the racks in the courtyard to dry. The horizontal poles from which the cloth is festooned are twenty to twenty-five feet from the ground. It is most interesting to see the workman pile the wet material on the end of a bamboo pole in such a manner that when the pile is raised between two horizontal poles of the rack, half can be shaken off to fall over one pole and half over the other.

Finishing Cotton Piece Goods

After drying, the material is finished by starching and calendering. Wheat, bean, or rice flour, whichever is produced in the vicinity and is thus cheapest, is used for starching. The calendering is done cold by pressing the material, damp with starch, with smooth stones. The apparatus used is crude but produces results. It is so unique that a description is well worth while.

Native Method of Calendering

The essential parts of the apparatus are two large stones (see Fig. 2), usually of granite, a three-inch diameter hardwood roller about thirty inches long, and two coolies. One stone is sunk in the ground so that its top plane is parallel to it and extends above the floor of beaten earth about six inches. The top is rectangular, about two feet wide by three feet long and slightly concave.

The other and movable stone is shaped like a V, with a truncated point and short legs. The bottom of the V has about the same dimensions as the top of the bed (two by three feet) and is flat.

In operation a few turns of cloth are wrapped around the roller which is then placed across the bed stone. The V stone is lifted on (it weighs a hundred to a hundred and fifty pounds). A coolie climbs on top of it, balances himself by grasping a pole fastened at a convenient height, places one foot on each point of the V and rocks the stone up and down, making the roll go back and forth across the bed. When the first few turns of cloth have been pressed flat and smooth more is rolled up on the cylinder and the rocking continued until finally the whole piece of cloth has been rolled up and pressed. It is the business of the second coolie to squat at one end of the bed stone and feed in the cloth. The piece is removed from the wooden cylinder, folded, tagged with a large picture label

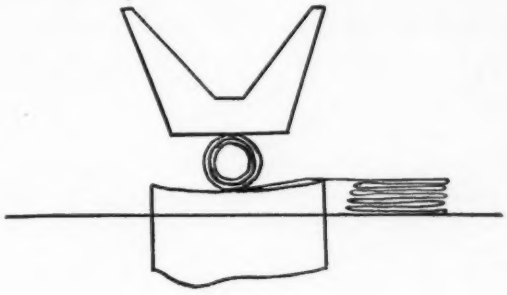

Fig. 2

printed in bright colors, wrapped in paper, and is then ready for market.

A smooth, glossy finished cloth results which compares very favorably with anything produced with modern machinery.

Signs of a Progressive Spirit

In a few weaving centers away from the treaty ports attempts are being made to introduce more modern methods of finishing. The writer has in mind one small town in particular where a progressive merchant has had installed a large steam boiler and a small steam engine. These were hauled many miles overland in a section of country where boat traffic is impossible and real roads practically non-existent. This power plant has been set up in a Chinese house and a home-made laundry mangle constructed to be operated by it. This mangle is constantly in use on cloth produced on hand looms in the town, and the owner claims to be so satisfied with results that he is going to enlarge the plant rapidly.

As indicative of a progressive spirit this and similar cases which might be mentioned are illuminating, but it will be at least another generation before the stone "rockers" feel the effects of modern finishing methods.

(*To be continued*)

Andrew Spence, connected with the dyeing department of the Amoskeag Manufacturing Company, Manchester, N. H., for fifty-six years, has retired and will receive a pension.

Robert H. Nicols has taken a position as overseer of finishing for the Standish Worsted Company, Plymouth, Mass.

Technical Notes from Foreign Sources

Retting Cocoanut Husk

A study of the conditions under which the retting of cocoanut is accomplished in different localities, correlated with the results of experimental work, indicates that effective retting depends mainly on suitable water conditions, the requisite organisms, which included a long rod bacterium, a short rod bacterium and possibly a mould, being found in the husk itself, irrespective of the district in which the palm was grown. These organisms attack and resolve the water-insoluble mucilaginous material, which is disseminated through the cork cells of the husk and gives it cohesion.

Discoloration of the fiber is due to the presence in the husk of tannins, which may cause "bluing" of the fiber through contact with ferruginous water or "reddening" of the fiber as a result of oxidation. In order to obtain products which show the minimum of discoloration, ripe nuts should be used and the husk, after removal, should be set to steep with as little delay as possible. The water should be changed sufficiently often to avoid organisms being poisoned by the products of their action, but in such a way that the accumulating bacteria are not washed away or their activity checked by a reduction of the temperature.

Diminished bacterial action results in the non-removal of dissolved oxygen from the water, and consequent oxidation of any residual tannins with the production of discolored fiber. After retting is complete the product must be thoroughly washed to remove all corky matter. The process normally requires ten to twelve months but might, it is suggested, be completed in about three months if all the husks, after soaking until bacterial growth was well established, were rapidly passed through heavy rollers and immediately returned to another previously prepared pit. The production of fiber of good color by digestion with water, etc., under pressure is impracticable (unless digestion could be accomplished under anaerobic conditions) owing to the readiness with which the tannins oxidize to colored compounds.

This abstract is taken from a paper which appeared in the Journal of the Indian Institute of Sciences, 1924, pages 39-52.

Substantive and Mordant Condensation Products

German patent No. 288,186 is concerned with a process for manufacturing non-dyeing condensation products of the aromatic series containing sulphur. These products are obtained by the action of disulphur dichloride on phenol or a melt of sulphur and phenol, which products are then oxidized or reduced. The substances obtained in this manner are not dyestuffs but possess substantive and mordant properties.

The oxidation is effected by hydrogen peroxide and the reduction by sodium hydrosulphite or sulphoxylate. Examples are given of the oxidation by hydrogen peroxide of the resin which is produced from phenol and disulphur dichloride, and the reduction by sodium hydrosulphite of the resin formed from cresol and disulphur dichloride. The synthetic resins and the product obtained by prolonged heating of a mixture of para chlorophenol, sulphur sodium sulphide and water, and treating with hydrochloric acid, also yield non-dyeing sodium salts, which are soluble in water, when melted with the calculated quantity of sodium hydroxide and a sufficient quantity of sodium sulphoxylate.

Pare, baryta and fibers such as wool, silk and cotton are colored by the unpurified resins of dull yellow, which is fast to washing. They are not colored by the oxidized or reduced products, but the colorless constituent which remains on the fiber is fast to washing and forms with basic dyestuffs a clear lake of constant tint and great fastness to light.

Coloring Wool with Alizarine Dyes

The original article on this subject, which is concerned with the production of deep tones on wool with the aid of alizarine dyestuffs was published in the Revue Generale Teinture Impr. Blanch. Appret. The author first discusses the advantages that are to be gained from the use of the artificially prepared alizarine over the natural dyestuff. He discussed as well the properties of the alizarine dyes and particularly their fastness to light and atmospheric influences. It is also brought out that with the same alizarine dye it is possible to obtain different colors according to the nature of the mordant employed in the dyeing operation. This property of alizarine dyes is of special importance in wool dyeing.

For many years experiments were carried out to dye wool first with indigo and then mordant it with alumina and tartaric acid. Then the cloth was allowed to remain for forty-eight hours and thereafter it was washed and finally dyed with a mixture of carmine, indigo, archil and fustic. However, the color obtained in this manner was not fast to light. But if the archil is is supplanted by alizarine and the fustic omitted altogether, then a color is obtained which is completely fast to light. Then, when the indigo is replaced by Alizarine Blue, the fastness of the dyed fabric is even greater than before.

As far as the action of mordants is concerned the following may be mentioned: With alumina mordants ordinary alizarine gives deep rose-toned shades. Violet to black colorations are obtained with iron mordants. Mixtures of iron and aluminum salts give browns. Chromium salts give red and brown, uranium salts give a very fine gray. The nickel mordants are of no consequences. Tin salts are seldom used and then only in order to enhance

the brilliancy of tones produced with the aid of alumina mordants.

In the close of his paper the author gives an account of various mordant baths which are used in dyeing practice. A few of these are given below.

In the first place, there is the alumina mordant bath for woolen goods. One kilogram of wool is boiled for one and one-half hours in a mixture which contains 100 grams of alum, 50 grams of tartaric acid and 10 grams of tin salt. The cloth is introduced into the alizarine dye liquor either in the cold or lukewarm condition. Then the solution is slowly heated to the boiling point. With alizarine itself a yellowish red is obtained, but when a little calcium acetate is added the color becomes bluer. The addition of chalk has the effect of freshening up the tone, but when this is done the fastness of the color is somewhat impaired. It is possible to vary the shades obtained by this method of dyeing by varying the concentration of the mordant bath, by the addition of various substances and by the use if nitroalizarine.

The chrome mordant bath consists of potassium bichromate or sodium bichromate on the one hand, chrome alum, or basic chromic acetate or basic chromic nitroacetate. When the bichromates and chrome alum are employed, tartaric acid or oxalic acid is added to the mordant bath. Frequently a small amount of copper sulphate is also employed.

Uranium salts are too costly to be used in common practice. But it is said that a fine gray can be obtained by using as little as 5 grams of the uranium salt to 1 kilogram weight of wool.

The author recommends that in all dyeing operations a little Turkey Red Oil be added to the last washing bath, or glycerine if the oil is not available. This serves to give the wool a soft handle. In certain cases the use of gelatine with formaldehyde, whereat an insoluble compound of the two substances is formed at elevated temperatures, is indicated as a sizing material.

Bleaching in the Cold

The following abstract, which appeared in the Der Textilchemiker und Colorist, September, 1924, is taken from a publication issued by the Sorau Institute for Research, Vol. II, No. 4. It contains the results that were obtained in three separate experiments on the cold-bleaching of linen yarn.

The tests were carried out with various grades of tow and flax yarns of German manufacture, with the exception of certain flax yarns of Russian origin. The treatment consisted of the following: The yarns were placed in a liquor of 11 to 17.5 deg. Be. for a period of two hours; the ratio of liquor to yarn was 8 to 1. The liquor possessed varying contents of caustic soda as follows: 12 per cent, 7.25 per cent, 4.5 per cent, figured on the weight of the fiber. After this treatment the yarn was washed, soured, washed again and pressed between rollers.

Another treatment consisted in subjecting the material to one hour's contact with a chlorine liquor at ordinary temperatures, the ratio of the liquor being from 1 to 10.8 to 1 to 9.8. The chlorine content of the liquor varied from 0.82 to 4.08 to 4.12 grams of chlorine per liter of the liquor. In this case as well, after treatment of the yarn in the liquor the yarn was washed, soured, washed again and pressed.

The results of the first experiment were that the color of the yarn was not completely removed, due to the fact that the concentration of the first chlorine bath was too low. Increase in the concentration of the bleach liquor was found to give good results.

In general, the conclusions were drawn that the cold bleached yarns differed somewhat in handle and external appearance from the warm bleached goods. They were a little coarser. It remains to be seen whether or not this disadvantage will have a harmful effect on the finished woven cloth.

New Bleaching Agent

The process patented in French Patent No. 563,583 is concerned with the manufacture of a new stable bleaching agent in the solid condition. This agent also possesses disinfecting properties.

The new agent is of the hypochlorite of lime type, basic compounds being formed of this salt. These are obtained by reaction with lime on chloride of lime, which latter is prepared by the action of chlorine on milk of lime. The crystals formed in this reaction are separated and dried.

These complex compounds have very stable properties and will not decompose even when heated to as high a temperature as 110 deg. Cent. The hypochlorite salt contains as much as 38 per cent of chlorine, has but a slight odor, will not destroy the packages in which it is shipped and is quite insensitive to the temperatures which will positively destroy ordinary chloride of lime. When dissolved in water, the new bleaching agents are simply split up into calcium hypochlorite and hydrated lime.

Cotton Fibers Indifferent to Substantive Colors

Cotton fibers, after they have been given successive treatments with a solution of sodium hydroxide in ethyl alcohol and an aromatic sulphochloride, have been found to possess no affinity for direct cotton dyestuffs, and are therefore suitable for the production of multicolored fabrics. The process is carried out in the following manner:

The cotton fiber, which is first bleached and freed from all fatty and greasy matters, is then steeped for about one hour in an alcoholic solution containing approximately 13 per cent of caustic soda. The excess of the liquor is removed by centrifuging or pressing.

The resulting alkali-cellulose is then treated at a temperature varying between 85 and 95 deg. Cent. for one hour with 40 parts of toluene containing para toluenesulphochloride (300 per cent calculated on the weight of the cellulose), and after completion of the reaction the cellulose product is thoroughly washed with soap solution and water at a temperature of 60 deg. Cent. and then dried.

During this treatment the cotton shrinks but increases in weight Para toluenesulphochloride may be replaced by other sulphochlorides, such as benzenesulphochloride, xylenesulphochloride, naphthalenesulphochloride, and also their chloro, bromo and nitro derivatives.

DYE IMPORTS TAKE BIG JUMP IN OCTOBER

The first significant effect of the automatic reduction of 15 per cent in the duty on foreign dyes is shown in a 259 per cent increase over September figures in dye imports recorded for the month of October and just made public by the Chemical Divisions of the Department of Commerce and of the Tariff Commission.

October imports of dyes reached the surprising total of 577,542 pounds with an invoice value of $606,000. The imports during September came to only 160,978 pounds. The highest import figures for this year previous to October were recorded for March and totaled 293,862 pounds. The October import figures, it will be noted, are nearly double this amount.

The total imports of dyes entering the port of New York during October came to 440,466 pounds. In addition the October import figures include imports through other ports as follows: 135,140 pounds, valued at $148,532 through Providence; 1,356 pounds, valued at $935, through Boston; 500 pounds, valued at $490, through Hartford; 55 pounds, valued at $117, through Chicago, and 25 pounds, valued at $198, through Detroit. The grand total for all ports reporting was 577,542 pounds.

In an explanation of this large jump in dye imports the report from the Department of Commerce says:

"The increase of 259 per cent in the imports of dyes for consumption in October over those of the previous month, September, may be largely accounted for by several factors:

"1. The large withdrawals of dyes from bonded warehouses following the reduction in the ad valorem rate of duty on dyes from 60 per cent to 45 per cent on September 22, 1924. The warehouse stocks of dyes on October 31st are not yet available. The figures, however, for the months of August and September are given below, as reported in Monthly Summary of Foreign Commerce of the United States, Department of Commerce.

"Dyes remaining in bonded customs warehouse, August 31, 1924, coal tar dyes and colors, 507,338 pounds; coal tar intermediates, 1,081,287 pounds. September 30, 1924, coal tar dyes and colors, 559,661 pounds; coal tar intermediates, 1,111,656 pounds.

"2. The reduction in the ad valorem rate of duty, effective September 22, 1924. The 15 per cent reduction in the ad valorem rate has more directly affected the higher priced dyes, and the imports of this group have recorded the largest increases during the month.

"3. The third factor which explains in part the increased imports during October is the improvement in the activity of the textile industry."

Of October total imports for consumption, 64 per cent came from Germany, 21 per cent from Switzerland, 2 per cent each from Italy and England, 7 per cent from Canada, 3 per cent from France, and 1 per cent from other countries.

The five leading dyes by quantity imported last month were: Indanthrene Golden Orange R, 33,019 pounds; Hydron Pink, 27,498 pounds; Indanthrene Blue BCS, 19,605 pounds; Hydron Orange, 19,080 pounds, and Diaminogene, 18,400 pounds.

DYES AND CHEMICALS WANTED

We buy for spot cash surplus and odd lots of chemicals, oils, dyes, intermediates, solvents, gums, glues, waxes and any item of a chemical nature. Republic Chemical Company, 303 Pearl Street, New York City.

DYESTUFF SALESMAN

Position open for a man familiar with the purchase and sale of aniline dyes. All communications absolutely confidential. Address Box 274, American Dyestuff Reported.

TEXTILE CHEMIST

Textile chemist with broad scientific and executive experience desires position installing and maintaining scientific control of materials and processes in a textile mill. Address Box 275, American Dyestuff Reporter.

PHILADELPHIA SALESMAN

One of the leading manufacturers and importers of dyestuffs has an opening for a man of more than average ability in the Philadelphia territory. In addition to good character and ability, the applicant possesses an established clientele and familiarity with the chief consumers of dyestuffs and textile chemicals in and around Philadelphia. Salary and commission commensurate with the candidate's past record will be paid. Address Box 278, American Dyestuff Reporter.

EXPERIENCED HELPER

Young man, graduate in chemistry of the German Polytechnic at Karlsruhe, and having had several months' experience in the application laboratories of Fried. Bayer & Co. at Leverkusen, seeks an opportunity to enter a dyehouse as second hand or helper where he may have an opportunity to familiarize himself with American methods. Address Box 277, American Dyestuff Reporter.

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A bright vat orange possessing superior fastness qualities

This latest addition to the Sulfanthrene series produces clear shades of reddish orange of excellent fastness, particularly to washing and chlorine.

It is, therefore, especially recommended for the dyeing of all fabrics where fastness to washing is essential.

Sulfanthrene Orange R can be used either as a self-color or in combination with other dyestuffs of the same class for the production of fancy shades.

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Dyestuffs Department
Wilmington Delaware

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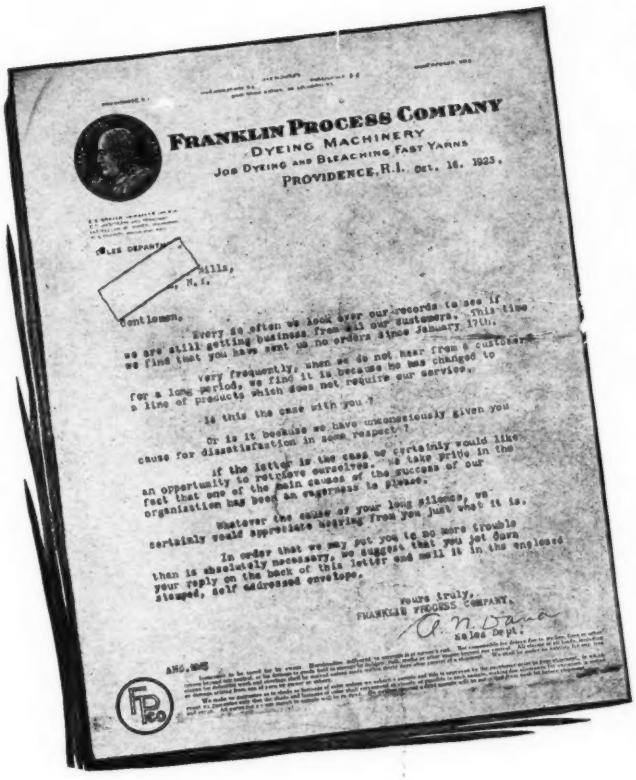

FRANKLIN PROCESS COMPANY
DYEING MACHINERY
JOB DYEING AND BLEACHING FAST YARNS
PROVIDENCE, R.I. Oct. 16, 1923.

Gentlemen.

Every so often we look over our records to see if we are still getting business from all our customers. This time we find that you have sent us no orders since January 17th.

Very frequently, when we do not hear from a customer for a long period, we find it is because he has changed to a line of products which does not require our service.

Is this the case with you?

Or is it because we have unconsciously given you cause for dissatisfaction in some respect?

If the latter is the case we certainly would like an opportunity to retrieve ourselves. We take pride in the fact that one of the main causes of the success of our organization has been an eagerness to please.

Whatever the cause of your long silence, we certainly would appreciate hearing from you just what it is.

In order that we may put you to no more trouble than is absolutely necessary, we suggest that you jot down your reply on the back of this letter and mail it in the enclosed stamped, self addressed envelope.

Yours truly,
FRANKLIN PROCESS COMPANY,
Sales Dept.

What We Wrote

and some typical replies

YARN DEALER

Replying to your letter of the 19th, the only reason that we have not been sending you any of our work is because we have not had occasion to use material of this description.

However you may rest assured that the next time we have any use for your dyeing, we shall be very glad to place the same with you.

HOSIERY MANUFACTURER

Referring to Mr. Dana's letter of October 19, since we placed our last order with you we have not had occasion to use any dyed yarn. When we are again in the market, you will have an opportunity to figure on our requirements.

NARROW FABRIC MANUFACTURER

No dissatisfaction. We are filling an order in natural at present.

WORSTED MANUFACTURER

Replying to your inquiry of the 18th have to advise that at the present time we are not in the market for your service.

Also, have to advise that your service at all times has been most satisfactory, and the only reason you have not received any business from us is lack of orders on fabrics which require your service.

HOSIERY MANUFACTURER

The reason you have not heard from us of late is that it is only during the season when we are at work on our fall line that we use a dyed yarn such as we obtained from you.

At the present time we have upwards of 1,000 to 2,000 lbs. of this 60/1 Black on hand, but as soon as we are out of this yarn, we will then order an additional quantity from you.

NOVELTY FABRIC MANUFACTURER

The reason we have not given you any business since August 31st, is because we are kept busy on silk just now. However, we intend starting on the cotton in a couple of months from now, at which time you will hear from us again.

MANUFACTURER OF SHIRTINGS

Replying to your inquiry of October 19th. Please note that we are not using any colored yarn at the present time.

We might state however that what yarn you have dyed for us in the past has been entirely satisfactory.

MANUFACTURER OF TINSEL CORDS

In answer to yours of October 18th would state that we are still using your yarn although at present we are buying the same through Wm. W. Bevan Co., Parkway & Vine St., Everett, Mass.

NARROW FABRIC MANUFACTURER

Due entirely to change in styles. We have found your service satisfactory and will communicate with you when again in need.

NOVELTY YARN MANUFACTURER

Your letter of the 19th inst. received. In reply would say that we are preparing 60/1 yarn to send you for dyeing black. We will send it as quickly as we get it ready.

WORSTED SUITINGS MANUFACTURER

Replying to your letter of October 18th, wish to say that we are using very little of the dyed yarns this season.

Should we, however, have any need for same, we will gladly give you our business as your service in the past was very satisfactory.

HOSIERY MANUFACTURER

We have no complaint whatever to make against your organization, as our relationship and service obtained from you have been very satisfactory.....

When we are again in the market for anything new we will certainly give you the benefit of our business.

TOWEL MANUFACTURER

Our silence has not been long although it may seem long to you. When in need of dyed yarn we think of Franklin.

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